03.06-4/0/92-00588

FINAL

QUALITY ASSURANCE PROJECT PLAN

REMEDIAL INVESTIGATION
CAMP ALLEN LANDFILL

UNITED STATES NAVAL BASE
NORFOLK, VIRGINIA

CONTRACT TASK ORDER 0084

Prepared For:

NAVAL FACILITIES
ENGINEERING COMMAND
ATLANTIC DIVISION
Norfolk, Virginia

Under the

Navy CLEAN Contract
Contract N62470-89-D-4814
(LANTDIV NAVFACENGCOM)

Prepared By:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

APRIL 23, 1992

THIS VOLUME IS THE PROPERTY OF:

FINAL

QUALITY ASSURANCE PROJECT PLAN
REMEDIAL INVESTIGATION

UNITED STATES NAVAL BASE
NORFOLK, VIRGINIA

CONTRACT TASK ORDER 0084

Prepared For:

NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
Norfolk, Virginia

Under the

NAVY CLEAN CONTRACT
CONTRACT N62470-89-D-4814
(LANTDIV NAVFACENGCOM)

Prepared By:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

Approved: ______________________________ Date: ______________
Baker Environmental Project Manager
Thomas E. Artman

Approved: ______________________________ Date: ______________
Baker Environmental Lab QA Officer
S. Charles Caruso

Approved: ______________________________ Date: ______________
LANTDIV Engineer-in-Charge

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

LIST OF FIGURES

LIST OF TABLES

DISTRIBUTION:

S. Charles Caruso - Baker Environmental Laboratory Quality Assurance Officer
Thomas E. Artman - Baker Environmental Project Manager
William D. Trimbath - Baker Environmental Program Manager
John W. Mentz - Baker Environmental Deputy Program Manager
John C. Barone - Baker Environmental Field Quality Assurance Officer
Kenneth H. Walker - LANTDIV Engineer-in-Charge

1.0 INTRODUCTION

This Final Quality Assurance Project Plan (QAPP) has been developed for the Remedial Investigation (RI) of the Camp Allen Landfill at the U.S. Naval Base in Norfolk, Virginia. The preparation of this QAPP is being performed under the Navy CLEAN Contract Task Order 0084. This project will be managed through the Naval Facilities Engineering Command, Atlantic Division (LANTDIV). Prior investigations of hazardous waste sites at Camp Allen have included an Initial Assessment Study, a Site Suitability Assessment Study and an Interim Report of the Installation Restoration (IR) Program. Since these initial studies, the Navy has changed its program to follow rules, regulations, guidelines, and criteria established by the U.S. Environmental Protection Agency (USEPA) for the Superfund Program.

This current project will be conducted according to the EPA Remedial Investigation/Feasibility Study (RI/FS) format. The objectives of this study are to conduct sampling and analysis, and to fill in data gaps in order to complete the Remedial Investigation stage for Site #1, Areas A and B, of the Camp Allen Landfill.

The project will include a geophysical survey, Geoprobe investigation, soil borings, surface water/sediment/soil sampling, monitoring well installation, groundwater sampling, air sampling (at the Brig), slug tests, an aquifer test, and residential water well sampling. The present effort will build on the data generated in the Initial Assessment Study and Confirmation Report. The effort will include identification and quantitation of pollutant concentrations, and the extent of contamination. Details of the proposed sampling are presented in the Sampling and Analysis Plan.

The specific sampling tasks for conducting this RI will include:

<u>Wells</u>

- Ten newly installed monitoring wells at Area A (including seven 65-foot deep wells, two 110-foot deep wells, and one shallow 30-foot deep stainless steel well).

- One 65-foot deep piezometer.

- Eight newly installed monitoring wells at Area B (including three 65-foot deep wells and five 25-foot deep wells).

Borings

- Eight 20-foot borings in the vicinity of existing well B-20W at Area A.
- Ten 40-foot borings in the landfill (Area A).
- Ten 10-foot borings in the landfill (Area B).

Surface Water/Sediment/Surface Soil

- Twenty-six sediment samples from 20 locations (Area A).
- Eight surface water samples (Area A).
- Eight sediment samples from six locations (Area B).
- Five surface water samples (Area B).
- Three composite surface soil samples from 15 locations (Area B).

Other

- Five residential well samples.
- Twenty-two existing monitoring wells from Area A.
- Fourteen existing monitoring wells from Area B.
- Air sampling at the Brig Facility (including four interior and four exterior air samples).

This QAPP has been prepared in accordance with the "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," EPA (QA MS-005/80) December 1980, and "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program," Naval Energy and Environmental Support Activity (NEESA 20.2-047B).

This plan addresses the quality assurance and quality control (QA/QC) procedures that will be utilized for sample collection and analysis for the Remedial Investigation as described in the Work Plan and Sampling and Analysis Plan (SAP). This specific information concerning sample handling and analytical methods are presented in Sections 6.0 and 9.0 respectively.

2.0 SCOPE OF QUALITY ASSURANCE PROJECT PLAN

This Final Quality Assurance Project Plan (QAPP) addresses sample collection and analysis to be conducted for the Remedial Investigation at the United States Naval Base, in Norfolk, Virginia. The Final QAPP has been developed for the Navy in accordance with U.S. Environmental Protection Agency (USEPA) guidelines. Contractors will follow QA/QC practices and procedures, including chain-of-custody procedures, while conducting all sample collection and analysis activities.

In order to provide adequate QA/QC regarding samples collected and analyzed, this investigation will require:

1. A NEESA-certified analytical laboratory.

2. Use of accepted analytical methods for the samples outlined by the Sampling and Analysis Plan. Analysis of samples for hazardous constituents parameters will be performed using USEPA's "Contract Laboratory Program Statement of Work for Organic Analysis," March, 1990; and "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," 3rd Edition (SW-846), November, 1986.

3. Field audit(s) during initial sampling activities to verify that sampling is being performed according to the Plan.

The structure of this QAPP and the QA elements addressed are:

- Title Page
- Introduction
- Table of Contents
- Project Description
- Project Organization
- QA Objectives for Data Measurement
- Sampling Procedures
- Sample and Document Custody
- Calibration Procedures and Frequency
- Analytical Procedures
- Data Reduction, Validation, and Reporting
- Internal QC Checks
- Performance and System Audits
- Preventive Maintenance
- Data Measurement Assessment Procedures
- Corrective Action
- QA Reports to Management

3.0 PROJECT DESCRIPTION

An introduction to the Remedial Investigation describing the project objectives and scope is given in Section 1.0 of the Work Plan. This section discusses the objectives of the Remedial Investigation, site background information, and site history. The proposed schedule for implementation of this investigation is given in Section 6.0 of the Work Plan. A description of the field investigation including sample sites location and designation, sampling procedures and frequency is presented in Sections 3.0 and 4.0 of the Final Sampling and Analysis Plan.

4.0 PROJECT ORGANIZATION

Technical performance of this Remedial Investigation at the U. S. Naval Base and for key personnel responsible for quality assurance throughout its duration are the Project Manager and Project Geologist. The contractor will utilize subcontractors to perform laboratory analysis, data validation, drilling and monitoring well installation, and surveying. Specific subcontractors have not yet been identified. Figure 4-1 shows the project organization, lines of authority, and support personnel/organizations. Resumes of key project personnel are provided as Appendix B.

The responsibilities of some key personnel are presented below:

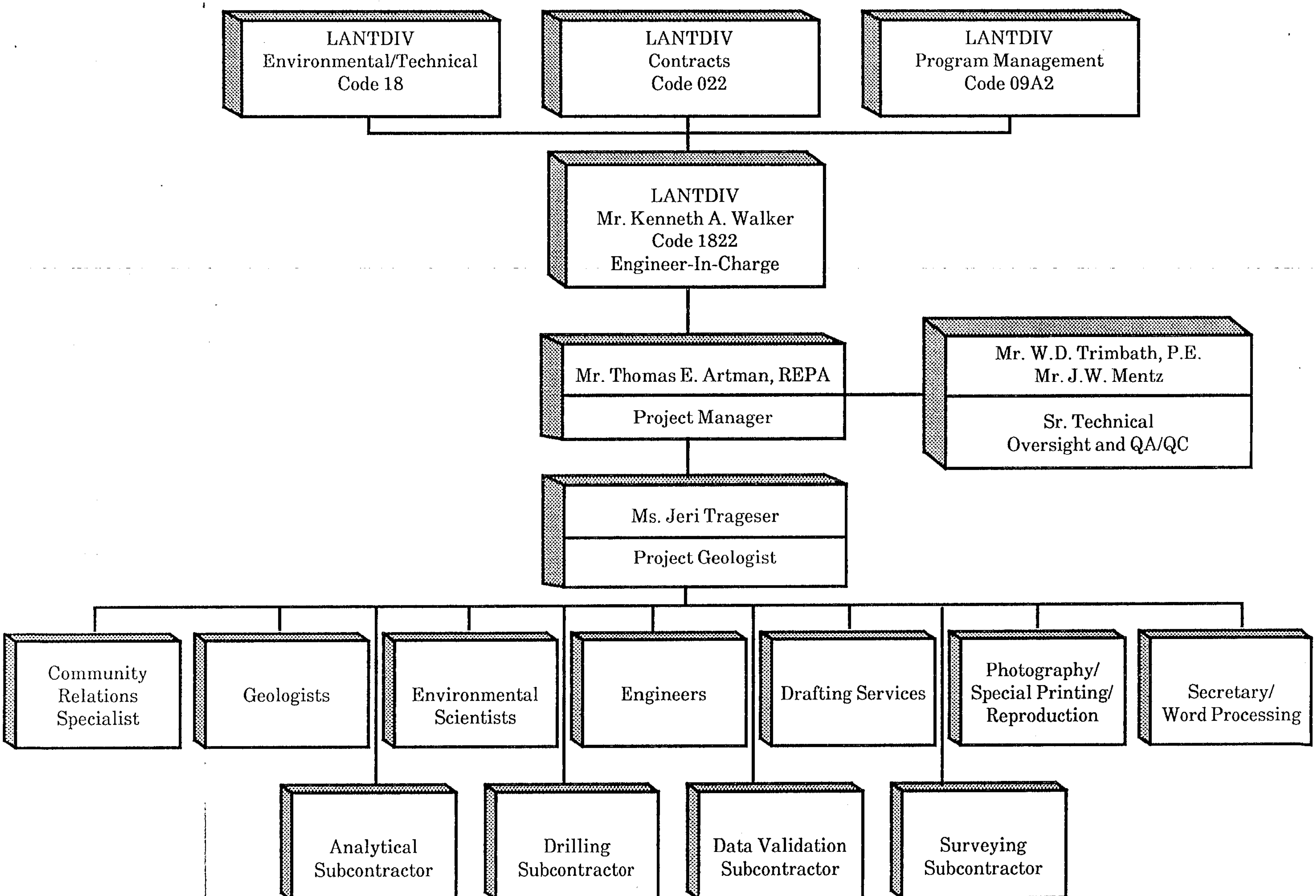
1. The Program Manager, Mr. William D. Trimbath, P.E., has final responsibility and authority for all work performed under the project. He will manage the day-to-day operations of the entire contract and the Navy CLEAN Program Management Office. He will provide overall program direction, client contact and quality assurance. From a quality perspective, the Program Manager is responsible for:

   - Ensuring, through an effective quality assurance program, that program and project direction is implemented and accomplished;
   - Approving and funding the quality assurance program;
   - Participating actively in the quality assurance process; and,
   - Assisting the Quality Assurance Officers, as necessary.

   Mr. Trimbath is with Baker Environmental, Inc., Coraopolis, Pennsylvania and can be reached at (412) 269-2007.

2. The Deputy Program Manager, Mr. John W. Mentz, will serve as the primary technical contact with subcontractors, with responsibilities for budget and schedule control, project management, and health and safety issues. From a quality perspective, the Deputy Program Manager has responsibilities similar to those outlined above for the Program Manager. Mr. Mentz is with Baker Environmental, Inc., Coraopolis, Pennsylvania and can be reached at (412) 269-2008.

FIGURE 4-1
PROJECT ORGANIZATION



3. The Project Manager, Mr. Thomas A. Artman, is responsible for managing all work for this CTO, from initiation to final closeout. He is responsible for maintaining budget, schedule, and technical performance as well as quality performance for the CTO. The Project Manager shall receive support from all project management staff and use the capabilities of the technical staff. The Project Manager is responsible for implementing and maintaining all aspects of this Quality Assurance Program for a CTO. Mr. Artman is with Baker Environmental, Inc., Coraopolis, Pennsylvania and can be reached at (412) 269-2017.

4. Project Quality Assurance Officers (QAOs)

   Two Quality Assurance Officers will assist the Project Manager in monitoring the quality assurance activities. These Quality Assurance Officers (QAOs) are: Dr. S. Charles Caruso, Laboratory Quality Assurance Officer; and Mr. John Barone, Field Quality Assurance Officer. The QAOs will assist the Project Manager in identifying and implementing project QA/QC procedures and requirements. Some responsibilities of the Quality Assurance Officers include:

   - Verifying that the Project Manager and project team implement the appropriate level of QA/QC;

   - Assisting in the development of data quality objectives, and preparation and review of QAPPs;

   - Verifying observance of chain-of-custody and document control procedures;

   - Initiating corrective actions; and,

   - Oversight of project startup to ensure that all QA/QC systems and procedures are in place and properly operating.

   The Laboratory Quality Assurance Officer also is responsible for monitoring the performance and operations of the analytical laboratories to ensure their adherence to quality assurance procedures. Included in this activity is verifying that all analyses are conducted in accordance with the proper method and level of QA/QC to ensure the required precision and accuracy, and verifying the acceptability of all laboratory data and the associated QA/QC evaluation. The LQAO will also have oversight responsibility over the Data Validation Subcontractor. Dr. Caruso is with Baker Environmental, Inc., Coraopolis, Pennsylvania and can be reached at (412) 269-2018.

The Field Quality Assurance Officer (FQAO) is responsible for monitoring all aspects of the field investigation including sampling, transporting of samples to the laboratory to ensure that QA/QC guidance and protocols are being strictly followed, and that consistency between CTOs is maintained. Mr. Barone is with Baker Environmental, Inc., Coraopolis, Pennsylvania and can be reached at (412) 269-2034.

5.0 QUALITY ASSURANCE OBJECTIVES FOR DATA MEASUREMENT

The purpose of a QA Program is to establish policies for the implementation of regulatory requirements and to provide an internal means for control and review so that the work performed is of the highest professional standards.

5.1 Project Quality Assurance Objectives

Project QA objectives are:

- Scientific data will be of a quality sufficient to meet scientific and legal scrutiny.
- Data will be gathered/developed in accordance with procedures appropriate for the intended use of the data.
- Data will be of acceptable precision, accuracy, completeness, representativeness, and comparability as required by the project.

The fundamental mechanisms that will be employed to achieve these quality goals can be categorized as prevention, assessment, and correction:

- Prevention of errors through planning, documented instructions and procedures, and careful selection and training of skilled, qualified personnel.
- Assessment of all quality assurance sampling and analysis reports furnished by the contract laboratory.
- Correction for prevention of reoccurrence of conditions adverse to quality.

The plan, prepared in direct response to these goals, describes the QA Program to be implemented and the quality control (QC) procedures to be followed by the laboratory during the course of the project.

The plan presents the project organization and specifies technical procedures, documentation requirements, sample custody requirements, audit and corrective action provisions, etc. to be applied to provide confidence that all activities meet the intent of the QA program. The plan has been prepared in accordance with USEPA guidance as presented in "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAMS-005/80.

The procedures contained or referred to herein have been taken from:

- "Statement of Work for Inorganic Analysis," USEPA, March 1990
- "Statement of Work or Organic Analysis," USEPA, March, 1990
- Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," USEPA, (QAMS 005/80).
- "Methods for the Chemical Analysis of Water and Wastes," USEPA, EPA-600/4-79-020, March 1979
- "Inductively Coupled Plasma - Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes, Method 200.7," EPA, 40 CFR Part 136, Appendix C.

5.2 Data Quality Objectives

Data quality objectives (DQOs) are qualitative or quantitative statements developed by the data users to specify the quality of data needed from a particular data collection activity to support a specific decision. The DQOs are expressed in terms of precision, accuracy, representativeness, completeness, and comparability. Definitions for these terms, as well as for the more general term uncertainty, are given in Table 5-1.

The Project Manager, in conjunction with the Navy Engineer-in-Charge (EIC), is responsible for defining the DQOs. The intended use of the data, analytical measurements, and the availability of resources are integral in development of DQOs. DQOs define the level of uncertainty in the data that is acceptable for each specific activity during the investigation. This uncertainty includes both field sampling error and analytical instrument error. Ideally, zero uncertainty is the goal; however, the variables associated with sampling and analysis contribute to a degree of uncertainty in any data generated. It is an overall program objective to keep the total uncertainty within an acceptable range, so as not to hinder the intended use of the data. To achieve this objective, specific data quality requirements such as detection

TABLE 5-1

DEFINITIONS OF DATA QUALITY INDICATORS

PRECISION - A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is expressed in terms of the standard deviation. Comparison of replicate values is best expressed as the relative percent difference (RPD). Various measures of precision exist depending upon the "prescribed similar conditions".

ACCURACY - The degree of agreement of a measurement (or an average of replicate measurements), X, with an accepted reference or true value, T, expressed as the difference between the two values, X-T. Accuracy is a measure of the bias in a system.

REPRESENTATIVENESS - Expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental concern.

COMPLETENESS - A measure of the amount of the valid data obtained from the measurement system compared to the amount that was expected under “normal” conditions.

COMPARABILITY - Expresses the confidence with which one data set can be compared with another.

UNCERTAINTY - The likelihood of all types of errors associated with a particular decision.

limits, criteria for accuracy and precision, sample representativeness, data comparability, and data completeness have been specified.

The goals for precision, accuracy, and completeness for this project will be assessed using results from internal as well as field quality control samples. The following criteria will be used to evaluate the data:

- Accuracy will be assessed through the use of spike (matrix and blank) recoveries. The goals are recoveries between 75 and 125 percent.

- Precision will be determined by the calculated relative percent difference between duplicate analyses. The duplicate analyses can be either spiked duplicate analyses or simply duplicate analyses of a sample. The precision goals are of less than 25 percent RPD for aqueous samples.

- Completeness - the objectives for completeness are of 95 percent.

The Data Quality Objective for this project is Level D, which is defined in Section 1.3.2 of "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (NEESA 20.2-047B). Level D requires the use of CLP methods for the analytes described in the CLP SOW, requires that the methods used must be EPA methods or be equivalent to EPA methods as presented in tables 7.1 through 7.5 of the NEESA 20.2-047B document. The laboratory that will be contacted to conduct these analyses will be NEESA approved, i.e., the laboratory must successfully analyze a performance sample, undergo an on-site audit, correct any deficiency found during the audit, and provide Monthly Progress Reports to the NEESA.

In Level D, the current CLP QC requirements are specified for methods not described in the CLP, the blank, blank/spike, matrix spike, and matrix spike duplicate shall be performed for every 20 samples of similar matrix. The analytical procedures to be used for this project along with the Quantitation Limits are presented in Section 9 of this plan.

The data set deliverables for Level D QA are given in Section 7.2 of NEESA 20.2-047B. A CLP data package is required. This includes a summary part and the rest of the package, which includes initial and continuing calibration, matrix spikes, matrix spike duplicates, blanks, duplicates, surrogate recoveries, chromatograms, mass spectra, and absorbance data. For methods which are not described by the CLP, the calibration information, method blanks, blank/spikes, the chromatograms, absorbance, matrix spikes and matrix spike duplicates shall be required. Also, the control charts plotted using the blank/spikes data shall be included.

All measurements will be made so that results are representative of the media and conditions being measured. All data will be calculated and reported in units consistent with the practice for reporting similar data to allow comparability of data bases among organizations.

The data collected during the course of the site investigation will be used:

- To monitor health and safety conditions during field activities;
- To identify releases or suspected releases of hazardous waste and/or constituents;
- To characterize the wastes contained and/or managed; and,
- To screen from further investigation those areas which do not pose a threat to human health or environment.

6.0 SAMPLING PROCEDURES

Descriptions of the procedures to be used for sampling the groundwater, surface water, sediment and soil at the site are provided in Section 5.0 of the Sampling and Analysis Plan (SAP). The number of samples, sampling locations, and sampling rationale by media also are presented in the Sampling and Analysis Plan. Sample handling procedures, including sample containers, preservatives, holding times, etc., are discussed in Section 7.1 and summarized in Tables 7-1 and 7-2.

Filtered samples for metals analyses will be collected as required for determining dissolved metals. This will require a filtration in the field with the acid preservative added to the filtrate. The appropriate procedure is presented in the SAP.

The reagents used for preservatives must be of the highest purity and are provided by the laboratory contracted to analyze the samples. The laboratory will also provide the high purity water and solvents required in the field (e.g., decontamination of sampling equipment).

The Project Manager has the responsibility for coordination of all activities required to achieve the objectives of this project. This includes the sampling activities and the required analytical services. The Project Manager or his designee will coordinate sample collection and delivery to the laboratory.

7.0 SAMPLE AND DOCUMENT CUSTODY PROCEDURES

Sample custody procedures outlined in this section have been developed from "User's Guide to the Contract Laboratory Program," December 1986, OSWER Directive No. 9240.0-01. These procedures are in accordance with "EPA NEIC Policies and Procedure Manual," May 1978, revised November 1984, EPA 330-78-001-R and "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," December 1980, QAMS-005/80.

The purpose of this section is to outline the sample handling and sample documentation procedures to be used during implementation of the Sampling and Analysis Plan. The objective of the sample handling procedures is to deliver representative samples to the laboratories for analysis. The objectives of the sample documentation procedures are to: (1) ensure complete analysis of the requested parameters within the required turnaround times; and (2) document the sample from the point of collection to the final data report.

7.1 Sampling Handling

New polyethylene or glass bottles containing the proper preservatives will be provided by the laboratory for sample collection. In addition to the chemical preservatives, samples will be stored on ice at 4°C in a waterproof metal or sturdy plastic cooler, if required (see Tables 7-1 and 7-2 for summaries of containers, preservation, and holding times for water and soil/sediment samples).

7.2 Chain-of-Custody Procedures

A sample is considered to be in an individual's possession if:

- It is in the sampler's possession or it is in the sampler's view after being in his(her) possession;
- It was in the sampler's possession and then locked or sealed to prevent tampering; or
- It is in a secure area.

TABLE 7-1

SUMMARY OF CONTAINERS, PRESERVATION AND HOLDING TIMES FOR WATER SAMPLES

Parameter	Bottle Requirements	Preservation Requirements	Holding Time (2)	Analytical Method	Bottle Volume
Volatile Organic Compounds (VOA)	glass teflon lined cap	Cool to 4°C 1:1 HCL pH <2	10 days	CLP	2 x 40 ml
Semi-Volatile Organic Compounds (SVOA)	glass teflon lined cap	Cool to 4°C	Extraction within 5 days Analyze 40 days	CLP	2 x 1 liter
PCB/Pesticides	glass teflon lined cap	Cool to 4°C	Extraction within 5 days Analyze 40 days	CLP	2 x 1 liter
Metals (TAL) (1)	plastic/glass	HNO_3 to pH <2	180 days except Mercury is 26 days	CLP	1 x 1 liter
Chloride	plastic/glass	None required	28 days	EPA 325.3	1 x 1 liter
Sulfate	plastic/glass	Cool to 4°C	28 days	EPA 375.4	1 x 1 liter
Alkalinity	plastic/glass	Cool to 4°C	14 days	EPA 310.1	1 x 1 liter

(1) Dissolved metals - filter sample before addition of acid.
(2) Holding times for CLP methods are based on Validated Time of Sample Receipt as stated in CLP statement of work of February, 1991.

TABLE 7-2

SUMMARY OF CONTAINERS, PRESERVATION AND HOLDING TIMES FOR SOIL/SEDIMENT SAMPLES

Parameter	Bottle Requirements	Preservation Requirements	Holding Time (1)	Analytical Method	Bottle Volume
Volatile Organic Compounds (VOA)	glass teflon lined cap	Cool to 4°C	10 days	CLP	1 x 50 gm
Semi-Volatile Organic Compounds (SVOA)	glass teflon lined cap	Cool to 4°C	Extraction within 10 days Analyze 40 days	CLP	1 x 250 gm
PCB/Pesticides	glass teflon lined cap	Cool to 4°C	Extraction within 10 days Analyze 40 days	CLP	1 x 50 gm
Metals (TAL)	plastic/glass	Cool to 4°C	Mercury is 26 days 180 days	CLP	1 x 50 gm

(1) Holding times for CLP methods are based on Validated Time of Sample Receipt as stated in the CLP statement of work of February, 1991.

Five kinds of documentation will be used in tracking and shipping the analytical samples:

- Field log book;
- Sample labels;
- Chain-of-Custody (COC) records;
- Custody seals; and
- Commercial carrier airbills.

At a minimum, the label for each sample bottle will contain the following information:

- Name of sampling organization;
- Preservative;
- Remarks;
- Sample description;
- Site name;
- Site location;
- Sample ID number;
- Date and time of collection;
- Sample type (grab or composite);
- Matrix; and
- Sampler's initials.

The sample information, as well as the analysis to be performed on the sample, will be entered in the field log book for each sampling point. Additionally, the following items will be entered:

- Dates and times of entry;
- Names of field personnel on site;
- Names of visitors on site;
- Field conditions;
- Description of activities;
- Sampling remarks and observations;
- QA/QC samples collected;
- List of photographs taken; and
- Sketch of site conditions.

Custody of the samples will be maintained by field personnel from the time of sampling until the time they are forwarded to the analytical laboratory.

The sample custody is documented using Chain-of-Custody (COC) records. Field personnel will complete a COC record, in waterproof ink, to accompany each cooler forwarded from the site to the laboratory. Any errors on the COC records will not be erased; instead, a line will be drawn through the error and initialed by the person completing the form. The original copy will be placed in a sealable plastic bag and put inside the appropriate cooler, secured to the cooler's lid.

If the sample cooler is to be shipped by commercial air carrier, the cooler must be secured with custody seals so that the seals would be broken if the cooler was opened. The commercial carrier is not required to sign the COC record as long as the custody seals remain intact and the COC record stays in the cooler. The only other documentation required is the completed airbill.

If the sample shipment is hand delivered to the laboratory by field personnel or retrieved by laboratory personnel at the site, then the custody seals are not necessary. The laboratory sample custodian, or his/her designee accepting the sample shipment, whether it is from the air carrier or the field personnel, signs and dates the COC record upon sample receipt. The original COC record will be returned along with the final data report. The laboratory will be responsible for maintaining internal log books and records that provide a custody record during sample preparation and analysis.

Laboratory Chain-of-Custody Procedures

Upon sample receipt the following are performed:

- Samples are received and unpacked in the laboratory where the staff checks for bottle integrity (loose caps, broken bottles, etc.).

- Samples are verified with incoming paperwork (packing slip, etc.) by type of bottle and stabilizer. The paperwork is either signed or initialed.

- Information concerning the sample (from the sampling record, Chain-of-Custody, and observation) is recorded along with parameters to be analyzed, date of sampling, and date the sample is received in the laboratory.

- Samples are placed in an appropriate secured storage area, e.g. refrigeration, until analysis.

- When analysis is complete, samples are stored for a 30-day period unless otherwise specified.

If collected samples arrive without Chain-of-Custody or incorrect Chain-of-Custody records, the following steps are taken:

- The laboratory prepares a nonconformance form stating the problem.
- The site supervisor and Project Manager are notified.
- If the missing information cannot be reconstructed by the Project Manager or field staff, the samples affected are removed from the sampling program.

Primary considerations for sample storage are:

- Secured storage.
- Maintain prescribed temperature, if required, which is typically 4 degrees Celsius.
- Extract and/or analyze samples within the prescribed holding time for the parameters of interest.

The Laboratory Quality Assurance Plan (LQAP) will provide more detail concerning procedures for disbursement of samples for analysis, sample tracking, procurement of chemicals, and lab disposal practices.

7.3 Document Custody Procedures

Project records are necessary to support the validity of the work, to allow it to be recreated if necessary, and to furnish documentary evidence of quality. The evidentiary value of data is dependent upon the proper maintenance and retrieval of quality assurance records. Therefore, procedures are established to assure that all documents attesting to the validity of work are accounted for when the work is completed.

Records are legible, filled out completely, and adequately identified as to the item or activity involved. Records are considered valid only if initialed, signed, or otherwise authenticated and dated by authorized personnel. These records may either be originals or reproduced copies. Records submitted to the files, with the exception of correspondence, are bound, placed in folders or binders, or otherwise secured for filing.

Following receipt of information from external sources, completion of analyses, and issuance of reports or other transmittals; associated records are submitted to the proper file. In addition, records transmitted are adequately protected from damage and loss during transfer (e.g, hand carrying or making copies prior to shipment).

Calculations and checkprints; reports and other data transmittals; copies of proposals, purchase orders for project services, and contracts; correspondence including incoming and outgoing letters, memoranda, and telephone records; reference material are transferred to the proper file.

All individuals on the project staff are responsible for reporting obsolete or superseded project-related information to the Project Manager. In turn, the Project Manager notifies the project and laboratory staffs of the resulting status change in project documents, such as drawings and project procedures.

In general, outdated drawings and other documents are marked "void." However, the Project Manager may request the copies be destroyed. One copy of void documents is maintained in the project files with the reasons for, and date of voiding clearly indicated.

To denote calculations and other material which have not been formally checked, or based on information which has not been checked, or do not contribute to final project information; documents are marked "preliminary".

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 Field Instruments

Two field instruments will be used for health and safety monitoring: the HNu System portable photoionizer and the OVA. These instruments will be calibrated on site daily according to the manufacturer's instructions in addition to the factory calibration it will receive prior to the start of site sampling. The calibration standards will be recorded in the field log book along with any corrective actions taken.

A pH meter and a conductivity meter will be used to analyze groundwater and surface water samples. Procedures from "Test Methods for Evaluating Solid Waste," U. S. Environmental Protection Agency, SW-846, November 1986, 3rd Edition will be used to calibrate these meters.

A YSI Model 56 dissolved oxygen meter will be used to measure dissolved oxygen in surface water samples. The instrument will be calibrated in the field before each measurement or each group of closely spaced measurements. The procedure in the manufacturer's instructions and Baker's SOP F201 will be followed.

All standards used for calibration must be from the national Institute of Standards and Technology (NIST), traceable to NIST standards, or other accepted standards (e.g., USEPA).

8.2 Laboratory Instruments

The laboratory's procedures for calibration and related quality control measures are to be in accordance with the protocols presented in: "USEPA Contract Laboratory Program Statement of Work for Organic Analysis," "USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis," March 1990; and, "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983. Formal calibration procedures are established to ensure that instrumentation and equipment used for sample analysis are accurately calibrated and properly functioning. These procedures apply to all instruments and equipment quantities. All calibrations are performed by laboratory personnel or external agencies using standard reference materials per method specifications. The LQAP will provide more detail on procedures and frequency. This will be available when the laboratory subcontractor is obtained for this project.

All calibrations are recorded on in-house calibration forms or instrument vendor forms or in dedicated bound notebooks. The following data are recorded for all calibrations: the date, target readings, actual readings, instrument identification number, and the analyst's initials. Other data may be recorded depending upon the calibration performed.

Only properly calibrated and operating equipment and instrumentation are used. Equipment and instrumentation not meeting the specified calibration criteria are to be segregated from active equipment whenever possible. Such equipment is repaired and recalibrated before reuse.

All equipment is uniquely identified, either by serial number or internal calibration number, to allow traceability between equipment and calibration records. Recognized procedures (ASTM, USEPA, or manufacturer's procedures) are used for calibration whenever available.

8.2.1 Method Calibration

Method calibration is performed as part of the laboratory analytical procedure (calibration curves, tuning). Calibration curves are prepared using five standards in graduated amounts across the appropriate range of analysis. New calibration curves are prepared whenever new reagents or standards are prepared or yearly, whichever is more frequent.

8.2.2 GC/MS System Calibration Procedure

This section outlines the requirements for the calibration of GC/MS (or GC/MSD) systems for the determination of organic compounds. The following operations are performed in support of these requirements:

- Documentation of GC/MS mass calibration and abundance pattern
- Documentation of GC/MS response factor stability
- Internal standard response and retention time monitoring.

Tuning and Mass Calibration

It is necessary to establish that a given GC/MS system meets the standard mass spectral abundance criteria prior to initiating data collection. This is accomplished through the analysis of p-bromofluorobenzene (BFB) for volatile compounds or decafluorotriphenylphosphine (DFTPP) for semivolatile compounds. The BFB or DFTPP criteria are met before any blanks, standards, or samples are analyzed.

A GC/MS system used for organic compound analysis is tuned to meet the criteria specified in the EPA CLP protocol for BFB analysis (volatile compounds) or DFTPP (semivolatile compounds) for an injection of 50 nanograms (ng) of BFB or DFTPP. The analysis is performed separately from standard or blank analysis. These criteria are demonstrated every 12 hours of operation. Background subtraction, if required, is straight-forward to eliminate column bleed or instrument background ions. Calibration documentation is in the form of a bar graph spectrum and a mass listing.

GC/MS System Calibration

After tuning criteria have been met and prior to sample analysis, the GC/MS system is initially calibrated at five concentrations utilizing the compounds to be analyzed to determine the linearity of response. Internal and surrogate standards are used with each calibration standard. Standards are analyzed under the same conditions as the samples.

- Relative Response Factor (RRF) Calculation - The USEPA specifies the internal standard to be used on a compound-by-compound basis for quantification. The relative response factor (RRF) is calculated for each compound at each concentration level:

- System Performance Check - A system performance check is performed and the minimum average relative response factors are met before the calibration curve is used.

- Calibration Check - A calibration check is performed and the criteria are met before the calibration curve is used. The percent relative standard deviation (%RSD) is calculated using the relative response factors (RRF) from the initial calibration.

- Continuing Calibration - A calibration check standard containing all semivolatile or volatile compounds and surrogates is run each 12 hours of analysis. A system performance check is performed. The criteria are the same as for the initial calibration system performance check. A calibration check is also performed. The percent difference is determined for each CCC.

The % Difference for each CCC must be less than or equal to 25.0%. The system performance check and calibration check criteria must be met before sample analysis can be performed. The continuing calibration is recorded on the continuing calibration forms.

8.2.3 System Calibration Procedure for Metals Analysis

This section outlines the requirements for the calibration of atomic absorption (AA) and Inductively Coupled Plasma (ICP) systems for the determination of metals. The following are performed in support of these requirements:

- Documentation of standard response
- Correlation coefficient monitoring.

The AA or ICP system is initially calibrated with a calibration blank and five calibration standards. The standard concentrations are determined as follows. One standard is at a concentration near, but above, the MDL. The other concentrations correspond to the expected range of concentrations found in the actual samples. For AA systems, the calibration standards are prepared fresh each time an analysis is to be performed and discarded after use. The standards contain the same reagents at the same concentrations as will result in the samples following preparation.

This five point calibration is performed daily or before each use for metals analysis by ICP. For metals analysis by AA, the five point calibration is performed whenever new calibration standards are prepared.

<u>Correlation Coefficient Calculation</u>

The data points of the blank and the five calibration standards are utilized to calculate the slope, the intercept, and the correlation coefficient of the best fit line. An acceptable correlation coefficient must be achieved before sample analysis may begin. An acceptable correlation coefficient is >0.997 for AA analyses and >0.9999 for ICP analysis.

Calibration Verification

The initial calibration curve is verified on each working day by the measurement of one mid-range calibration standard. For analysis by AA or ICP, the acceptance criterion for the recovery of the verification standards is ±15% of the expected recovery for all metal standards except for the standard for mercury. The acceptance criterion for the recovery of the mercury standard is ±20% of the expected recovery. When measurements exceed the control limits, the analysis is terminated, the problem corrected, the instrument recalibrated, and the calibration reverified.

8.2.4 System Calibration Procedure for Inorganic Analyses

This section outlines the requirements that are used for calibration of colorimetric systems for analyses of inorganic parameters. The following are performed in support of these requirements:

- Documentation of standard response
- Correlation coefficient monitoring.

The system is initially calibrated with a blank and five calibration standards. Standard concentrations are one standard at a concentration near, but above, the MDL with additional concentrations corresponding to the expected range of concentrations found in actual samples. Standards contain the same reagents at the same concentrations as will be present in samples following preparation.

Correlation Coefficient Calculation

Data points of the blank and five calibration standards are utilized to calculate slope, intercept, and correlation coefficient of a best fit line. An acceptable correlation coefficient is achieved before sample analysis may begin. An acceptable correlation coefficient is >0.99 for all systems.

Calibration Verification

The initial calibration curve is verified on each working day by the measurement of two calibration standards. One standard is at a concentration near the low end of the calibration curve and one standard is at the high end of the curve. The acceptance criteria for recovery of verification standards is ±10% of the expected recovery. When measurements exceed control limits, analysis is terminated, the problem is corrected, the instrument is recalibrated, and the calibration is reverified.

8.2.5 Periodic Calibration

Periodic calibration is performed on equipment required in analyses but not routinely calibrated as part of the analytical methodology. Equipment that falls within this category includes ovens, refrigerators, and balances. The calibration is recorded either on specified forms or in bound notebooks. Discussed below are the equipment, the calibration performed, and the frequency at which the calibration is performed.

- Balances are calibrated weekly with class S weights.

- The pH Meter meter is calibrated daily with pH 4 and 7 buffer solutions and checked with pH 10 buffer solution.

- The temperatures of the refrigerators are recorded daily.

- All liquid in glass thermometers are calibrated annually with the National Bureau of Standards (N.B.S.) certified thermometer. Dial thermometers are calibrated quarterly.

- The N.B.S. Certified Thermometer is checked annually at the ice point.

The following equipment must maintain the following temperatures:

- Sample Storage & Refrigerators: 4° ± 2°C
- Water Bath, Mercury: 95° ± 2°C.

9.0 ANALYTICAL PROCEDURES

9.1 Field Analysis

An HNu PI-101 and OVA will be used to analyze ambient air for health and safety monitoring, as well as to screen soil for the soil sampling. The HNu PI-101 and OVA detects total organic vapor. These instruments will be operated in accordance with the manufacturer's instructions.

The dissolved oxygen (DO) concentration of surface water samples will be measured using a YSI Model 56 DO Monitor. The procedure in the manufacturer's instruction manual will be followed.

The pH and specific conductivity of aqueous samples also will be measured in the field. These analyses will be obtained in accordance with "Handbook for Sampling and Sample Preservation of Water and Wastewater," September 1982, EPA/600/4-82-029.

9.2 Laboratory Analysis

The samples that will be collected during the investigation will be analyzed for constituents listed in Table 9-1. Parameters will be analyzed using the methods specified for the EPA Contract Laboratory Program and other approved EPA methods as noted in Tables 9-1 and 9-2. Compounds and the corresponding method performance limits are listed in Table 9-1.

The laboratory that will be subcontracted with to perform the analyses will be NEESA Approved. The NEESA Approval process is described in the NEESA 20.2-047B document. As part of this process the laboratory must furnish their Laboratory Quality Assurance Plan (LQAP). This LQAP will provide a description of the laboratory facilities, laboratory credentials, laboratory equipment and source of supplies. In addition, the QA/QC procedures the laboratory will use to ensure the generation of scientifically valid and defensible data will be presented. The LQAP will also contain the necessary SOPs which describe the analytical procedures in sufficient detail to allow selection of the methods that will meet the Data Quality Objectives of the project.

TABLE 9-1

METHOD PERFORMANCE LIMITS

1. TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)

Volatiles by CLP Protocol	Quantitation Limits*		
	Water µg/L	Low Soil µg//Kg	Med. Soil µg/Kg
1. Chloromethane	10	10	1200
2. Bromomethane	10	10	1200
3. Vinyl Chloride	10	10	1200
4. Chloroethane	10	10	1200
5. Methylene Chloride	10	10	1200
6. Acetone	10	10	1200
7. Carbon Disulfide	10	10	1200
8. 1,1,-Dichloroethene	10	10	1200
9. 1,1-Dichloroethane	10	10	1200
10. 1,2-Dichloroethene (total)	10	10	1200
11. Chloroform	10	10	1200
12. 1,2-Dichloroethane	10	10	1200
13. 2-Butanone	10	10	1200
14. 1,1,1-Trichloroethane	10	10	1200
15. Carbon Tetrachloride	10	10	1200
16. Bromodichloromethane	10	10	1200
17. 1,2-Dichloropropane	10	10	1200
18. cis-1,3-Dichloropropene	10	10	1200
19. Trichloroethene	10	10	1200
20. Dibromochloromethane	10	10	1200
21. 1,1,2-Trichloroethane	10	10	1200
22. Benzene	10	10	1200
23. trans-1,3-Dichloropropene	10	10	1200
24. Bromoform	10	10	1200
25. 4-Methyl-2-pentanone	10	10	1200
26. 2-Hexanone	10	10	1200
27. Tetrachloroethene	10	10	1200
28. Toluene	10	10	1200
29. 1,1,2,2-Tetrachloroethane	10	10	1200
30. Chlorobenzene	10	10	1200
31. Ethyl Benzene	10	10	1200
32. Styrene	10	10	1200
33. Xylenes (Total)	10	10	1200

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

TABLE 9-1

METHOD PERFORMANCE LIMITS (Continued)

1. TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)

Semivolatiles by CLP Protocol		Quantitation Limits*		
		Water µg/L	Low Soil µg//Kg	Med. Soil µg/Kg
66.	Acenaphthene	10	330	10000
67.	2,4-Dinitrophenol	25	800	25000
68.	4-Nitrophenol	25	800	25000
69.	Dibenzofuran	10	330	10000
70.	2,4-Dinitrotoluene	10	330	10000
71.	Diethylphthalate	10	330	10000
72.	4-Chlorophenyl-phenyl ether	10	330	10000
73.	Fluorene	10	330	10000
74.	4-Nitroaniline	25	800	25000
75.	4,6-Dinitro-2-methylphenol	25	800	25000
76.	N-nitrosodiphenylamine	10	330	10000
77.	4-Bromophenyl-phenylether	10	330	10000
78.	Hexachlorobenzene	10	330	10000
79.	Pentachlorophenol	25	800	25000
80.	Phenanthrene	10	330	10000
81.	Anthracene	10	330	10000
82.	Carbazole	10	330	10000
83.	Di-n-butylphthalate	10	330	10000
84.	Fluoranthene	10	330	10000
85.	Pyrene	10	330	10000
86.	Butylbenzylphthalate	10	330	10000
87.	3,3'-Dichlorobenzidine	10	330	10000
88.	Benzo(a)anthracene	10	330	10000
89.	Chrysene	10	330	10000
90.	bis (2-Ethylhexyl) phthalate	10	330	10000
91.	Di-n-octylphthalate	10	330	10000
92.	Benzo (b) fluoranthene	10	330	10000
93.	Benzo (k) fluoranthene	10	330	10000
94.	Benzo (a) pyrene	10	330	10000
95.	Indeno (1,2,3-cd) pyrene	10	330	10000
96.	Dibenz (a,h) anthracene	10	330	10000
97.	Benzo (g,h,i) perylene	10	330	10000

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

\# Previously known by the name bis (2-Chloroisopropyl) ether

TABLE 9-1

METHOD PERFORMANCE LIMITS (Continued)

1. TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)

Semivolatiles by CLP Protocol	Quantitation Limits*		
	Water µg/L	Low Soil µg//Kg	Med. Soil µg/Kg
34. Phenol	10	330	10000
35. bis (2-Chloroethyl) ether	10	330	10000
36. 2-Chlorophenol	10	330	10000
37. 1,3-Dichlorobenzene	10	330	10000
38. 1,4-Dichlorobenzene	10	330	10000
39. 1,2-Dichlorobenzene	10	330	10000
40. 2-Methylphenol	10	330	10000
41. 2,2'-oxybis (1-Chloropropane)#	10	330	10000
42. 4-Methylphenol	10	330	10000
43. N-Nitroso-di-n-propylamine	10	330	10000
44. Hexachloroethane	10	330	10000
45. Nitrobenzene	10	330	10000
46. Isophorone	10	330	10000
47. 2-Nitrophenol	10	330	10000
48. 2,4-Dimethyphenol	10	330	10000
49. bix (2-Chloroethoxy) methane	10	330	10000
50. 2,4-Dichlorophenol	10	330	10000
51. 1,2,4-Trichlorobenzene	10	330	10000
52. Naphthalene	10	330	10000
53. 4-Chloroaniline	10	330	10000
54. Hexachlorobutadiene	10	330	10000
55. 4-Chloro-3-methylphenol	10	330	10000
56. 2-Methylnaphthalene	10	330	10000
57. Hexachlorocyclopentadiene	10	330	10000
58. 2,4,6-Trichlorophenol	10	330	10000
59. 2,4,5-Trichlorophenol	25	800	25000
60. 2-Chloronaphthalene	10	330	10000
61. 2-Nitroaniline	25	800	25000
62. Dimethylphthalate	10	330	10000
63. Acenaphthylene	10	330	10000
64. 2,6-Dinitrotoluene	10	330	10000
65. 3-Nitroaniline	25	800	25000

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

\# Previously known by the name bis (2-Chloroisopropyl) ether

TABLE 9-1

METHOD PERFORMANCE LIMITS (Continued)

1. TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)

Volatiles by CLP Protocol		Quantitation Limits*	
		Water µg/L	Soil µg//Kg
98.	alpha-BHC	0.05	1.7
99.	beta-BHC	0.05	1.7
100.	delta-BHC	0.05	1.7
101.	gamma-BHC (lindane)	0.05	1.7
102.	Heptachlor	0.05	1.7
103.	Aldrin	0.05	1.7
104.	Heptachlor epoxide	0.05	1.7
105.	Eudosulfan I	0.05	1.7
106.	Dieldrin	0.10	3.3
107.	4,4'-DDE	0.10	3.3
108.	Endrin	0.10	3.3
109.	Endosulfan II	0.10	3.3
110.	4,4'-DDD	0.10	3.3
111.	Endosulfan sulfate	0.10	3.3
112.	4,4'-DDT	0.10	3.3
113.	Methoxychlor	0.50	17.0
114.	Endrin ketone	0.10	3.3
115.	Endrin aldehyde	0.10	3.3
116.	alpha-Chlordane	0.05	1.7
117.	gamma-Chlordane	0.05	1.7
118.	Toxaphene	5.0	170.0
119.	Aroclor-1016	1.0	33.0
120.	Aroclor-1221	2.0	67.0
121.	Aroclor-1232	1.0	33.0
122.	Aroclor-1242	1.0	33.0
123.	Aroclor-1248	1.0	33.0
124.	Aroclor-1254	1.0	33.0
125.	Aroclor-1260	1.0	33.0

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

There is no differentiation between the preparation of low and medium soil samples in this method for the analysis of Pesticides/Aroclors.

TABLE 9-1

METHOD PERFORMANCE LIMITS (Continued)

2. INORGANIC TARGET ANALYTE METALS (TAL) BY CLP PROTOCOL

Analyte	Contract Required Detection Limit µg/L
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	3
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20

TABLE 9-1

METHOD PERFORMANCE LIMITS (Continued)

3. OTHER INORGANIC ANALYTES

Analyte	Method	Detection Limit Water
Alkalinity	EPA 310.1	20 mg/L
Chloride	EPA 325.2	2 mg/L
Sulfate	EPA 375.4	5 mg/L

TABLE 9-2

PREPARATION METHOD REFERENCE

Parameter	Method Reference	
	Water	Soil
Volatile Organic Compounds (VOA)	CLP SOW Organics Exhibit D, VOA Section II	CLP SOW Organics Exhibit D, VOA Section II
Semivolatile Organic Compounds (SV)	CLP SOW Organics Exhibit D, SV Section II	CLP SOW Organics Exhibit D, SV Section II
Pesticide/PCBs (Pesticide)	CLP SOW Organics Exhibit D, Pest Section II	CLP SOW Organics Exhibit D, Pest Section II
TAL Metals	CLP SOW Inorganics Exhibit D, Section III	CLP SOW Inorganics Exhibit D, Section III
Alkalinity	EPA 310.1	NA
Chloride	EPA 325.2	NA
Sulfate	EPA 375.4	NA

10.0 DATA REDUCTION, VALIDATION AND REPORTING

10.1 Field Data Procedures

Data validation practices as described by "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses," U. S. Environmental Protection Agency, June 1988, and "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses," U. S. Environmental Protection Agency, February 1988 will be followed to insure that raw data are not altered and that an audit trail is developed for those data which require reduction. The documentation of sample collection will include the use of bound field log books in which all information on sample collection will be entered in indelible ink. Appropriate information will be entered to reconstruct the sampling event, including: site name (top of each page), sample identification, brief description of sample, date and time of collection, sampling methodology, field measurements and observations, and sampler's initials (bottom of each page, and dated).

A rigorous data control program will insure that all documents for the investigations are accounted for when they are completed. Accountable documents include items such as log books, field data records, correspondence, chain-of-custody records, analytical reports, data packages, photographs, computer disks, and reports. The Project Manager is responsible for maintaining a project file in which all accountable documents will be inventoried. The project records will be retained for a period of three years after project close-out; then the files will be forwarded to the Navy.

All the field data, such as those generated during field measurements, observations and field instrument calibrations, will be entered directly into a bound field notebook. Each project team member will be responsible for proofing all data transfers made, and the Project Manager or his/her designee will proof at least 10 percent of all data transfers.

10.2 Laboratory Data Procedures

The following procedures summarize the practices routinely used by laboratory staff for data reduction, validation, and reporting. Numerical analyses, including manual calculations, are documented and subjected to quality control review. Records of numerical analyses are legible and complete enough to permit reconstruction of the work by a qualified individual other than the originator. The equations and procedures used for calculations, as well as the units, are specified in the referenced analytical protocols.

Laboratory Data Validation

Data review begins with data reduction and continues through to the reporting of data.

Data processing is checked by an individual other than the analyst who performed the data processing. The checker reviews the data for the following:

- Utilization of the proper equations
- Correctness of numerical input
- Correctness of computations
- Correct interpretation of raw data (chromatographs, strip charts, etc.)
- Data is transferred to the proper forms and checked for transcription errors.

The checking process is thorough enough to verify the results. This must be approved by the Laboratory Quality Assurance Officer.

All entries made in benchbooks, data sheets, computation sheets, input sheets, etc. are made in ink. No entry will be rendered unreadable.

Data validation will be performed by a third party (not laboratory personnel) according to the guidelines referenced above.

Analytical Reports

The following are required of analytical reports:

- Data is presented in a tabular format.

- Analytical reports are approved by appropriate laboratory personnel.

- The following information is included on the report: client name and address, report date, sample date, analysis dates, number of samples, purchase order number, project number, and project type. All pages are numbered.

- The sample numbers and corresponding laboratory numbers are identified.

- The parameters analyzed, report units, and values are identified.

- Method, trip, and field blank results are reported.

- Matrix spike, matrix spike duplicate, and replicate recoveries are reported.

- Surrogate recoveries are reported.

- Holding times and sample analysis dates are reported.

- The detection limit of the procedure is identified.

- Consistent significant figures are used.

- Referenced footnotes are used when applicable.

- Blank results are not subtracted from sample results; they are treated according to the data validation guidelines referenced above.

- A letter of transmittal accompanies the report, if any anomalies are associated with the data. The letter specifies these anomalies.

All laboratory procedures for data reduction, validation, and reporting will be presented in the LQAP. The laboratory selected for this project will be NEESA Approved. The subcontractor's LQAP shall describe the mechanism for periodic reporting to management on the performance of measurement systems and data quality. These reports should include:

- Periodic assessment of analytical data accuracy, precision, and completeness;
- Performance audits results;
- System audits results;
- Significant QA problems and recommended solution; and
- Corrective action results.

The analytical laboratory shall maintain detailed procedures of laboratory recordkeeping in order to support the validity of all analytical work. Each data set report submitted to the Project Manager should contain the laboratory Project Manager's and QA Officer's written verification that the approved analytical method (without modification) was performed and all QA/QC checks were within the established protocol limits on all samples. If any QA problems are encountered during sample analysis, the laboratory will inform the Project Manager in writing. The laboratory QA Officer will provide the Project Manager reports of their QA audits by external agencies and of internal audits by their QA department upon request.

The Field Team Leader will report to the Project Manager on a frequent basis regarding progress of the field work and quality control issues associated with the field activities. All reports will be documented in a field logbook.

After the field work has been completed and the final analyses have been performed and checked, a final quality assurance report will be prepared for inclusion into the project final report (e.g., RI report). The report will summarize the quality assurance and audit information, indicating any corrective actions taken and the overall results of QA compliance. The Project Manager or his/her designate will prepare this final summary in coordination with the contract laboratory.

11.0 INTERNAL QUALITY CONTROL CHECKS

11.1 Field Internal Quality Control Checks

Field internal quality control checks to be used during the RI include field duplicates, equipment rinsates, field blanks, and trip blanks. The results from the field quality control samples will be used by the data validator to determine the overall quality of the data.

11.2 Types of QC Samples

Documentation of the analyses of the following types of QC samples is maintained in the laboratory bench notebooks and/or the specific client or project files.

Trip Blank

Analysis of trip blanks is performed to monitor possible contamination during shipment and collection of samples. Trip blanks are initiated in the laboratory prior to the shipping of sample packs. A corresponding trip blank is prepared for each set of samples to be analyzed for volatile organic compounds.

Trip blank samples are prepared by adding four drops of concentrated hydrochloric acid and then filling the container with deionized water (ASTM Type II). The trip blanks accompany the samples through shipment to the sample site, sample collection, shipment to the laboratory and storage of the samples.

If the analyses indicate contamination of the trip blank, the sample sources may be resampled. If the extent and nature of the contamination does not warrant such actions, the data will be accepted as valid.

Method Blank

Analysis of method blanks is performed to verify that method interferences caused by contamination in reagents, glassware, solvents, etc. are minimized and known.

Method blanks are initiated by the analyst prior to the preparation and/or analysis of the sample set. A method blank consists of a volume of deionized water or organic-free water equal to the sample volume which is carried through the entire analytical procedure. For solid samples to be analyzed by GC/MS, the method blank consists of a purified solid matrix approximately equal to the sample weight. A method blank is analyzed with each set of samples or at the very least, daily. If the analytical data of the method blank indicates excessive contamination, the source of contaminant will be determined. The samples may be reanalyzed or the data may be processed as is depending upon the nature and extent of the contamination.

Replicate Sample Analysis

Replicate sample analysis is performed to demonstrate the precision of an analysis. An interlaboratory replicate sample is initiated by the analyst prior to sample preparation and carried through the entire analytical procedure. The frequency of interlaboratory replicate analysis for each analyte is summarized in Table 11-1.

Spike Analysis

Spike analysis is performed to demonstrate the accuracy of an analysis. The analyst initiates the spike prior to sample preparation and analysis by adding a known amount of analyte(s) to a sample. The spike sample is carried through the entire analytical procedure. The frequency of spike analysis for each analyte(s) is summarized in Table 11-1.

Surrogate Standards

Surrogate standard analysis is performed to monitor the preparation and analyses of samples. All samples and blanks analyzed by GC/MS are fortified with a surrogate spiking solution prior to extraction or purging.

Internal Standards

Internal standard analyses are performed to monitor system stability. Prior to injection or purging, internal standards are added to all blanks and samples analyzed by GC/MS (refer to Section 5.1.1.).

TABLE 11-1

QC ANALYSIS FREQUENCY

Parameter	Replicate	Spike
Organic		
All analyses by GC/MS	10%	10%
Metals		
Liquids by flame AA or ICP	10%	10%
Solids by flame AA or ICP	10%	10%
All analyses by furnace AA	10%	10%
General Chemistry		
Alkalinity	10%	10%
Chloride	10%	10%
Sulfate	10%	10%

11.3 Laboratory Control Limits

Control limits are established for QC checks (spikes, duplicates, blanks, etc.). CLP control limits for surrogate standards spikes, and duplicates associated with GC/MS analyses and Pesticide/PCB analyses are adopted. Control limits for spikes, duplicates, and reference samples are determined internally through statistical analysis.

Whenever an out-of-control situation occurs, the cause is determined. Any needed corrective actions are taken.

Method Blanks

For metals analyses, the following criteria are used for method blank analysis:

- If the concentration of the method blank is less than or equal to the detection level, no correction of sample results is performed.

- If the concentration of the blank is above the detection level for any group of samples associated with a particular blank, the concentration of the sample with the least concentrated analyte must be 10 times the blank concentration, or all samples associated with the blank and less than 10 times the blank concentration must be redigested (reprepared) and reanalyzed.

The sample value is not corrected for the blank value unless, for AA and ICP analysis, a sufficient amount of sample is not available for reanalysis. In this case, the sample value is corrected for the blank value.

For GC/MS analyses, the following criteria are used for method blank analysis:

- A method blank for volatiles analysis must contain no greater than five times the detection limit of common laboratory solvents (common laboratory solvents are: methylene chloride, acetone, toluene, 2-butanone, and chloroform).

- A method blank for semivolatiles analysis must contain no greater than five times the detection limit of common phthalate esters.

- For all other compounds not listed above, the method blank must contain less than the detection limit of any single compound. If a method blank exceeds the criteria, the analytical system is considered to be out of control. The source of the contamination is investigated and appropriate corrective measures are taken and documented before sample analysis proceeds. All samples processed with a method blank that is out of control (i.e., contaminated) are reextracted/repurged and reanalyzed. Sample values are corrected for the blank value.

Surrogate Standards

For method blank surrogate standard analysis, corrective action is taken if any one of the following conditions exist:

- Recovery of any one surrogate compound in the volatile fraction is outside the required surrogate standard recovery limit.

- Recovery of any one surrogate compound in either of the semivolatile fraction is outside the surrogate standard recovery limits.

Corrective action will include the following:

- A check of the calculations for errors; a check of the internal standard and surrogate spiking solutions for degradation, contamination, etc.; and a check of instrument performance.

- Recalculation or reinjection/repurging of the blank or extract if the above corrective actions fail to solve the problem.

- Reextraction and reanalysis of the blank.

For sample surrogate standard analysis, corrective action is taken if any one of the following conditions exist.

- Recovery of any one surrogate compounds in the volatile fraction is outside the surrogate spike recovery limits.

- Recovery of any one surrogate compound in either semivolatile fraction is below 10 percent.

- Recoveries of two or more surrogate compounds in either semivolatile fraction are outside surrogate spike recovery limits.

Corrective action will include the following:

- A check of the calculations for errors; a check of the internal standard and surrogate spiking solutions for degradation,contamination, etc.; and a check of instrument performance.

- Recalculating or reanalysis of the sample or extract, if the above corrective action fails to solve the problem.

- Reextraction and reanalysis of the sample, if none of the above are a problem.

11.4 Quality Assurance Review of Reports, Plans, and Specifications

Prior to issuance of a final report, it is reviewed by knowledgeable members of the project staff, the Project Manager, or a designated representative. This review addresses whether:

- The report satisfies the scope of work, client requirements, and pertinent regulatory requirements.
- Assumptions are clearly stated, justified, and documented.
- A reference is cited for any information utilized in report preparation that was originated outside the project.
- The report correctly and accurately presents the results obtained by the work.
- The tables and figures presented in the report are prepared, checked, and approved according to requirements.
- The report figures are signed and dated by the appropriate members of the project staff and project management.
- The typed report has been proofread and punctuation, grammar, capitalization, and spelling are correct.

11.5 Laboratory Quality Assurance

Field Quality Assurance

Four types of field quality assurance/quality control samples will be submitted to the laboratory: trip blanks, equipment rinsates, field blanks, and field duplicates. A breakdown by type of sample with which the QA/QC samples will be submitted to the laboratories is given in Table 11-2. A summary of the number of environmental and QA/QC samples to be submitted for analysis is given in the Sampling and Analysis Plan.

TABLE 11-2

QA/QC SAMPLE FREQUENCY

Type of Sample	Metal	Organic
Trip Blank (for volatiles only)	NA(1)	One per cooler
Equipment Rinsate	One per day	One per day
Field Blank	One per matrix per day or one in 20	
Field Duplicates	10%	10%

(1) NA - Not applicable

12.0 PERFORMANCE AND SYSTEM AUDITS

A field audit will be conducted during the field investigation to verify that sampling is being performed according to the plan. A report will be submitted within 30 calendar days of completion of the audit. Serious deficiencies will be reported within 24 hours of the time of discovery of the deficiency, including actions taken or to be taken to correct such deficiencies.

The following table checklists (Tables 12-1 and 12-2) are used for audits. At the appropriate time, the Project Manager or his designee will conduct field audits.

The analytical subcontractor's LQAP must describe the external and internal performance evaluation tests and audits required to monitor the capability and performance of the total measurement process. These include system audits as required by Federal and State regulatory agencies to obtain and maintain laboratory certifications, commercial clients with auditing programs, and subscription to commercial auditing agencies. In addition, performance audits such as USEPA's Performance Evaluation Studies (drinking water and wastewater series), client sponsored performance evaluations, various government proficiency test samples to maintain laboratory certifications, and internal blind quality assurance samples should be discussed. In addition, the LQAP should define the acceptance criteria for the laboratory.

Laboratories that participate in the CLEAN Installation Restoration Program are required to obtain NEESA approval. This process consists of on-site laboratory audits, submittal of the LQAP, monthly reports, and periodic analyses of performance evaluation samples. Baker's responsibility is to ensure that the laboratory subcontractors selected have current NEESA certification. The NEESA Approval Process is described in the NEESA 20.2-047B document.

TABLE 12-1

SYSTEM AUDIT CHECKLIST - PROJECT OFFICE

Project No. ______________________ Date ______________________

Project Name & Location ______________________ Name & Signature of Auditor ______________________

Team Members ______________________ Name & Signature of Field Team ______________________

Yes _____ No _____ 1. Have a Program Manager, Project Officer and QA Officer been appointed?
Comments: ______________________

Yes _____ No _____ 2. Were project plans and QA/QC plans prepared?
Comments: ______________________

Yes _____ No _____ 3. Was a briefing held for project participants?
Comments: ______________________

Yes _____ No _____ 4. Were additional instructions given to the project participants?
Comments: ______________________

Yes _____ No _____ 5. Has a document control system been established and adhered to:
Comments: ______________________

Yes _____ No _____ 6. Have the individual files been assembled (field, sampling, laboratory, QA/QC)?
Comments: ______________________

Yes _____ No _____ 7. Is there a list of accountable field documents?
Comments: ______________________

TABLE 12-1
SYSTEM AUDIT CHECKLIST - PROJECT OFFICE
PAGE TWO

Yes ______ No ______ 8. Are standard operating procedures (SOPs) and other documentation of established procedures available?
Comments: ____
____
____

Yes ______ No ______ 9. Has coordination been established with contractors and the laboratory?
Comments: ____
____
____

Yes ______ No ______ 10. Have data review responsibilities been assigned?
Comments: ____
____
____

Yes ______ No ______ 11. Have reporting requirements been reviewed?
Comments: ____
____
____

Yes ______ No ______ 12. Has a data base been established?
Comments: ____
____
____

TABLE 12-2

SYSTEM AUDIT CHECKLIST - FIELD OPERATIONS

Project No. ____________________ Date ____________________

Project Name & Location ____________________ Name & Signature of Auditor ____________________

Team Members ____________________ Name & Signature of Field Team ____________________

Yes _____ No _____ 1. Is there a set of accountable field documents checked out to the Site Manager?
Comments: ____________________

Yes _____ No _____ 2. Is the transfer of field operations from the Site Manager to field participants documented in a log book?
Comments: ____________________

Yes _____ No _____ 3. Is there a written list of sampling locations and descriptions?
Comments: ____________________

Yes _____ No _____ 4. Are samples collected as stated in the project plan or as directed by the Site Manager?
Comments: ____________________

Yes _____ No _____ 5. Are samples collected in the type of container specified in the project plan or as directed by the Site Manager?
Comments: ____________________

Yes _____ No _____ 6. Are samples preserved as specified in the project plan or as directed by the Site Manager?
Comments: ____________________

TABLE 12-2
SYSTEM AUDIT CHECKLIST - FIELD OPERATIONS
PAGE TWO

Yes _____ No _____ 7. Are the number, frequency and type of samples collected as specified in the project plan or as directed by the Site Manager?
Comments: ______________________________

Yes _____ No _____ 8. Are the number, frequency and type of measurements taken as specified in the project plan or as directed by the Site Manager?
Comments: ______________________________

Yes _____ No _____ 9. Are samples identified with sample labels?
Comments: ______________________________

Yes _____ No _____ 10. Are blank and duplicate samples properly identified?
Comments: ______________________________

Yes _____ No _____ 11. Are sample and serial numbers for samples split with other organizations recorded in a log book or on a chain-of-custody record?
Comments: ______________________________

Yes _____ No _____ 12. Are samples listed on a chain-of-custody record?
Comments: ______________________________

Yes _____ No _____ 13. Is chain-of-custody documented and maintained?
Comments: ______________________________

Yes _____ No _____ 14. Are quality assurance checks performed as directed?
Comments: ______________________________

TABLE 12-2
SYSTEM AUDIT CHECKLIST - FIELD OPERATIONS
PAGE THREE

Yes ______ No ______ 15. Are photographs documented in logbooks as required?
Comments: ____
____
____

Yes ______ No ______ 16. Are all documents accounted for?
Comments: ____
____
____

Yes ______ No ______ 17. Have any documents been voided or destroyed?
Comments: ____
____
____

13.0 PREVENTIVE MAINTENANCE

13.1 Field Maintenance

The HNu PI-101 and OVA are to be used in site characterization and will be maintained as described by the manufacturer's instructions. The pH and specific conductance meters to be used during sampling will be maintained according to Appendix A, Field Water Quality Instruments. The manufacturers' instructions contain a spare parts list to be kept by the user and the manufactures provide a repair/maintenance service. The YSI Model 56 Dissolved Oxygen Monitor will be maintained according to the manufacturer's instruction.

13.2 Laboratory Maintenance

Preventive maintenance is an organized program of actions to prevent instruments and equipment from failing during use and to maintain proper performance of equipment and instruments. A comprehensive preventive maintenance program is implemented to increase the reliability of the measurement system. The preventive maintenance program addresses the following:

- Schedules of important preventive maintenance tasks that are carried out to minimize downtime.

- Lists of critical spare parts that are available to minimize downtime.

The laboratory maintains histories, in instrument/equipment logs, of all major equipment. Trouble shooting, maintenance, and spare parts inventory are recorded in the logs. Instruments and equipment are maintained periodically according to SW-846, third edition requirements, manufacturer's recommendation, and/or service contracts.

The modern analytical laboratory depends heavily upon instrumentation and equipment; therefore, cleaning and preventive maintenance are primary considerations in the sustained production of satisfactory data. Specific requirements for proper care of laboratory instrumentation and equipment are contained in the manufacturer's instructions; however, some general guidelines are considered.

- Special precautions are taken to avoid spillage of corrosive chemicals on or around equipment and instrumentation not only to extend the life of the item, but also to eliminate contamination.

- Where available, covers are placed on instrumentation when not in use.

- Instrument parts are cleaned as required (i.e., mirrors, probes, detector cells).

The analytical subcontractor will be Wadsworth/ALERT Laboratories, Inc.. The LQAP for the selected laboratory contains a section concerning Preventive Maintenance, which will include a spare parts list, as well as the source(s) of spare parts and repairs.

14.0 DATA MEASUREMENT ASSESSMENT PROCEDURES

14.1 Overall Project Assessment

Overall data quality will be assessed by a thorough understanding of the data quality objectives which are stated during the design phase of the investigation. By maintaining thorough documentation of all decisions made during each phase of sampling, performing field and laboratory audits, thoroughly reviewing the analytical data as they are generated by the laboratory, and providing appropriate feedback as problems arise in the field or at the laboratory, data accuracy, precision and completeness will be closely monitored.

14.2 Field Quality Assessment

To assure that all field data are collected accurately and correctly, specific written instructions will be issued to all personnel involved in field data acquisition by the Project Manager. The Project Manager will perform field audit(s) during the investigation to document that the appropriate procedures are being followed with respect to sample (and blank) collection. These audits will include a thorough review of the field books used by the project personnel to insure that all tasks were performed as specified in the instructions. The field audits will necessarily enable the data quality to be assessed with regard to the field operations.

The evaluation (data review) of field blanks, and other field QC samples will provide definitive indications of the data quality. If a problem that can be isolated arises, corrective actions can be instituted for future field efforts.

14.3 Laboratory Data Quality Assessment

As part of the analytical QA/QC program, the laboratory applies precision and accuracy criteria for each parameter that is analyzed. When analysis of a sample set is completed, QC data generated are reviewed and evaluated to ensure acceptance criteria are met. These criteria are method and matrix specific.

QA/QC data review is based on the following criteria:

- Method Blank Evaluation - The method blank results are evaluated for high readings characteristic of background contamination. If high blank values are observed, laboratory glassware and reagents are checked for contamination and the analysis of future samples halted until the system can be brought under control. A high background is defined as a background value sufficient to result in a difference in the sample values, if not corrected, greater than or equal to the smallest significant digit known to be valid. A method blank must contain no greater than two times the parameter detection limit for most parameters (1, 2).

- Trip Blank Evaluation - Trip blank results are evaluated for high readings similar to the method blanks described above. If high trip blank readings are encountered (i.e. a value sufficient to result in a difference in sample values, if not corrected, greater than or equal to the smallest significant digit known to be valid), procedures for sample collection, shipment, and laboratory analysis are reviewed. If both the method and the trip blanks exhibit significant background contamination, the source of contamination is probably within the laboratory. Ambient air in the laboratory and reagents are checked as possible sources of contamination (1).

- Standard Calibration Curve Verification - The calibration curve or midpoint calibration standard (check standard) is evaluated daily to determine curve linearity through its full range and that sample values are within the range defined by the low and high standards. If the curve is not linear, sample values are corrected. If average response factors are used to calculate sample concentrations, these factors are verified on a daily basis. Verification of calibration curves and response factors is accomplished when the evaluated response for any parameter varies from the calibrated response by less than ranges specified in Section 7.0 (1, 2).

- Duplicate Sample Analyses - Duplicate sample analyses are used to determine the precision of the analytical method for the sample matrix. Two types of duplicate samples are analyzed for this project, field and interlaboratory. Duplicate results are used to calculate precision as defined by the RPD. If interlaboratory duplicate values exceeds the control limit, the sample set are reanalyzed for the parameter in question. Precision limits are updated periodically following review of data (1, 2).

$$RPD = \frac{S(1) - S(2)}{M} \times 100$$

Where: S(1) is the result of sample 1 of duplicate pair
S(2) is the result of sample 2 of duplicate pair
M is the mean of S(1) and S(2)

- Reference Sample Analyses - The results of reference sample analysis are compared with true values, and the percent recovery of the reference sample is calculated. If correction is required (excessive or inadequate percent recovery), the reference sample is reanalyzed to demonstrate that the corrective action has been successful (1, 2).

- Surrogate Standard Analyses - Surrogate standard determinations are performed on all samples and blanks for GC/MS analyses. All samples and blanks are fortified with surrogate spiking compounds before purging or extraction to monitor preparation and analysis of samples. Recoveries must meet specific criteria. If acceptance criteria are not met, corrective action is taken to correct the problem and the affected sample is reanalyzed (1).

- Matrix Spike Analyses - The observed recovery of a spike added to a sample versus theoretical spike recovery is used to calculate accuracy as defined by the percent recovery (% R). If the accuracy value exceeds the control limit for the given parameter, the appropriate laboratory personnel are notified and corrective action is taken before the sample set is reanalyzed for the parameter in question (1, 2).

$$\% R = \frac{T-B}{S} \times 100$$

Where: T is the total amount of analyte
B is the background concentration of analyte
S is the amount of analyte spiked into a sample or blank

For completeness, it is expected that the methodology proposed for chemical characterization of the samples will meet QC acceptance criteria for at least 95% of all sample data. To ensure this completeness goal, sample data that does not meet the established criteria will be recollected, reextracted, or reanalyzed. Completeness is the percentage of the total measurements made which are judged to be valid measurements.

Data representativeness will be ensured through the use of appropriate analytical procedures, and analysis of samples performed within the allowed holding times.

Comparability is a qualitative characteristic of the data. By using standard methods for sampling and analyses, data generated in past or future investigations will be comparable with this investigation data.

14.4 Laboratory Data Validation

Review of analyses will be performed. A preliminary review will be performed by the Project Manager to verify all necessary paperwork (e.g., chain-of-custodies, traffic reports, analytical reports, and laboratory personnel signatures) and deliverables are present. A detailed quality assurance review will be performed by a data validation subcontractor to verify the qualitative and quantitative reliability of the data presented. This review will include a detailed review and interpretation of 10% of the data generated by the laboratory. The primary tools which will be used by experienced data validation personnel will be EPA CLP guidance documents, established criteria, and professional judgement.

A quality assurance report stating the qualitative and quantitative reliability of the analytical data will be prepared for NEESA. This report will consist of a general introduction section, followed by qualifying statements that should be taken into consideration for the analytical results to be best utilized. The report will reference NEESA 20.2-047B for applicable guidance, format, and standards.

During the data review, a data support documentation package will be prepared which will provide the back-up information that will accompany all qualifying statements present in the quality assurance review.

15.0 CORRECTIVE ACTION

Corrective action is taken whenever a nonconformance occurs. A nonconformance is defined as an event which is beyond the limits established for a particular operation by the plan. Nonconformances can occur in a number of activities. Such activities include sampling procedures, sample receipt, sample storage, sample analysis, data reporting, and computations.

The following personnel are responsible for detecting and reporting nonconformances:

- Project Staff - during testing and preparation and verification of numerical analyses.

- Laboratory Staff - during the preparation for analyses, performance of analytical procedures, calibration of equipment and quality control activities.

15.1 Corrective Action

Nonconformances are documented by the person originating or identifying it. Documentation includes the following:

- Identification of the individual(s) originating or identifying the nonconformance.
- Description of the nonconformance.
- Any required approval signatures (initials).
- Corrective action taken.
- Corrective action completion date.

Documentation of the nonconformance and corrective action taken is kept by the analyst and become part of the QA/QC files for the project.

The NEESA contract representative (NCR), along with the contract project director. will be notified of a nonconformance and corrective action taken, if one of the following is true:

- A nonconformance causes a delay in work beyond the schedule completion date.
- A nonconformance affects information already reported.
- A nonconformance affects the validity of the data.

15.2 Limits of Operation

The limits of operation that are used to identify nonconformances are established by the contents of the plan and by control limits produced by statistical analyses. The quality control check samples must compare favorably to the published USEPA or laboratory method performance criteria. For example, the analytical process is out of control and unacceptable if the recovery value is outside the laboratory control limits established by analyzing many standards and performing a statistical analysis of the data. Generally, the control limits are set at ± 3 times the standard deviation.

16.0 QUALITY ASSURANCE REPORTING PROCEDURES

The Project Manager will be responsible for assessing the performance of measurement systems and data quality related to the field investigation. A written record will be maintained of the results of laboratory QC reports and other periodic assessments of measurement, data accuracy, precision and completeness; performance and system audits; and any significant QA problems and recommended solutions. Each deliverable will contain a QA/QC assessment section. Also, a QA/QC assessment will be performed any time a significant problem is identified. A timetable for the project is presented in the Work Plan.

The contractor's Project Manager will keep in contact with the Navy Engineer-in-Charge at the U.S. Naval Base in Norfolk, Virginia through informal, verbal reports during the project as well as through monthly progress reports. These reports will include any changes in the QAPP. The final report for the project will include a separate QA section which summarizes data quality information contained in the periodic reports submitted to management and the client.

All reports are managed and secured in accordance with Baker's document control system (DCS). The documents to be managed by the DCS include CTO work plans, cost estimates, design documents, data and reports generated by CTO technical teams, results of laboratory analyses, agency file documents, QA reports and status reports. The DCS system also provides accountability for field documentation including such items as field logbooks, field data records, sample tags, chain-of-custody records and photographs.

APPENDIX A

FIELD WATER QUALITY INSTRUMENTS

APPENDIX A

FIELD WATER QUALITY INSTRUMENTS

A. Calibration and Preventive Maintenance

Activity Before Site Visit

Field meters to be used during sampling, specifically the pH and specific conductance/ thermistor meters will be checked against the contractor laboratory meters to insure proper calibration and precision response. Thermometers will be checked against a precision thermometer certified by the National Bureau of Standards. These activities will be performed by the contractor laboratory manager. In addition, buffer solutions and standard KCl solutions to be used to field calibrate the pH and conductivity meters will be laboratory tested to insure accuracy. The preparation date of standard solutions will be clearly marked on each of the containers to be taken into the field. A log which documents problems experienced with the instrument, corrective measures taken, battery replacement dates, when used and by whom for each meter and thermometer will be maintained by the contractor's laboratory manager. Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement, when necessary in the field.

All equipment to be utilized during the field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manuals and the instructions with each instrument to ensure that all maintenance items are being observed. A spare electrode will be sent with each pH meter that is to be used for field measurements. Two thermometers will be sent to each field site where measurement of temperature is required, including those sites where a specific conductance/thermistor meter is required.

Activity at Site

The pH meter must be calibrated a minimum of twice each day using at least two different pH buffer solutions expected to bracket the pH range of field samples. Rinse the probe thoroughly between buffer measurements with distilled water and again after calibration is completed. Record in the field log book what buffer solutions were used. When the meter is moved, check pH reading by measuring the pH value of the buffer solution closest to the expected range of the sample. If the reading deviates from the known value by more than 0.1 standard units, recalibrate the instrument as described above. If unacceptable deviations still occur, consult the operating manual for remedial course of action.

The specific conductance/thermistor meter is less likely to exhibit random fluctuations and will only require daily checks against a known KCl solution, which should be chosen to be within the expected conductivity range. Note that specific conductance is temperature-dependent and, therefore, the meter readings must be adjusted to reflect the temperature of the standard solution. Thoroughly rinse the probe with distilled water after immersing in KCl standard solution. In addition to daily checks of the conductivity readings, the thermistor readings must also be checked daily. This is accomplished by taking a temperature reading of the KCl standard solution with both the conductivity probe and a mercury thermometer.

Before use, visually inspect the thermometer to assure there is no break in the mercury column. If there is a break, visually inspect the spare thermometer. If both thermometers have a break in the mercury, neither can be used until the break is corrected. This may be done by cooling the bulb until the mercury is all contained in the bulb.

B. Analytical Methods

All field measurements will be obtained in accordance with "Handbook for Sampling and Sample Preservation of Water and Wastewater," EPA-600/4-82-029, September 1982 or "Test Methods for Evaluating Solid Wastes," SW-846, November 1986. The quality assurance procedures for field analysis and equipment are detailed in these documents cited.

APPENDIX B

RESUMES OF KEY PERSONNEL

BAKER ENVIRONMENTAL, INC. RESUMES

Thomas E. Artman, REPA

Site Investigation Department Manager

EDUCATION:

Edinboro University of Pennsylvania
B.S., Geology, Minor, Computer Science, 1984

Duquesne University
Corporate/Environmental Law
Paralegal Certification Program
Present Curriculum

Hazardous Materials Institute
Environmental Property Inspection, 1990

OSHA 1910.120 (e) (2)
Health and Safety Training

OSHA 1910.120 (e) (3)
8 Hour Supervisory Training
Adult CPR/ Standard First Aid Certification

REGISTRATION:

National Registry of Environmental Professionals
Registered Environmental Property Assessor (REPA 1144)

Application for American Institute of Professional Geologists and North Carolina Board for Licensing Geologists are currently being processed.

AFFILIATIONS:

Technical Advisor
Environmental Advisory Committee
Pittsburgh Boroughs, PA

Committee Member
State and Federal Legislative
Liaison Committee
National Registry of
Environmental Professionals

EXPERIENCE:

General Qualifications

Mr. Artman is the Site Investigation Department Manager responsible for activities related to management of CERCLA and RCRA sites. This includes comprehensive guidance for conducting Remedial Investigations and Feasibility Studies (RI/FS).

Also, specializing in facility and property environmental assessments, Mr. Artman has a thorough working knowledge of environmental regulations. Regulatory compliance evaluations include Federal, State and local regulations involving USTs, PCBs, asbestos, hazardous waste, water quality, air quality and right-to-know. Often incorporated into assessment projects is the development of hazardous waste management programs, waste minimization plans, and environmental audits and permit application completion.

Subsurface Investigation/Remedial Investigation Projects

- Superfund Site Characterization and Engineering Plan Development, PA
  Utilizing existing information and site observation points an Investigation Plan was developed and accepted by the US EPA including: MWs, downhole geophysics, electromagnetic surveys, groundwater/surface water sampling.

- Site Investigation , NAVCOMSTA, Sabana Seca, PR
  Characterization of geology and groundwater in subject area. Management of work plan development, field activities governed by US EPA/NEESA regulations.

- Manufacturing Facility Subsurface Cleanup, PA
  Remediation of TCE and DCE contaminated soils, groundwater monitoring/extraction system construction.

- Chemical Plant Subsurface Remediation, MD
  Remediation Plan development for subsurface solvent/dye contamination.

- Industrial Waste Landfill Application, WV
  Characterization of geology and groundwater in subject area. Typical investigative methods -- test pits, test borings, wells/piezometers, slug tests, and associated mapping/reporting

- Municipal Waste Landfill Application, PA
  Characterization of geology and groundwater in subject area. Typical investigative methods -- test borings, wells/piezometers, slug-tests, 48 hour pump test.

- Municipal Waste Landfill Applications (2), OH
  Characterization of geology and groundwater in subject area. Typical investigative methods -- test pits, test borings, wells/piezometers, slug tests, and associated mapping/reporting

Regulatory Compliance

- Projects involving automotive, chemical, metal working and steel mill facilities operational requirements. This includes air emission source permitting, asbestos management, NPDES permit applications/monitoring reports, hazardous waste management activities, waste minimization program development, SWMU studies, Right-to-Know training/ program development, UST/AST management, etc.

  Partial Project Listing:
  RCRA Closure Application, USX Geneva, Utah
  RCRA Closure Costing, American Foundries, Ohio
  RCRA Closure Plan Implementation, General Electric, Ohio
  SWMU Study, Part B Application, American Cyanamid, Ohio
  RCRA SWMU Closure, American Cyanamid, West Virginia
  SARA, Air Permitting, Irvine Industries, Mississippi

Complete Environmental Compliance - NPDES, PPC, RTK, Asbestos, USTs, PCBs, Temporary EPA ID, RIDC, Pennsylvania
Outfall Study, USX Lorain, Ohio

Phase I/II/III Environmental Site Assessments

- Managed Phase I Environmental Assessments of industrial/commercial properties - management, investigation, and reporting of project scopes including: site history, visual observations, and environmental concerns relating to historic land use and existing site conditions.

- Upon suspicion of contamination or libelous condition - developed and implemented Phase II studies including investigative methods to confirm/characterize suspect items. Also developed, where required, Phase III corrective action/remediation plans - development and bid solicitation for qualified contractors - supervision and cleanup certification.

Partial Project Listing:
TAKATA Industries (12 sites throughout USA and Mexico)
North Star Steel, Ohio
Westinghouse LRI, Pennsylvania
Westinghouse Airbrake, Pennsylvania
SH Bell Company, Pennsylvania, Ohio, Illinois
Allied Welding, Pennsylvania
Plexco Inc., Ohio
West Penn Chemical, Pennsylvania
Various Commercial Properties, Pennsylvania, Ohio

USTs/ASTs Management

- Developed government, gas station, steel mill and industrial park client management programs for USTs/ASTs including: inventories, registrations, recordkeeping, monitoring and reporting requirements. Corrective/remediation action planning including: contractor bid solicitation for tank tightness testing, tank removal, contaminated soil removal and clean closure verification.

Partial Project Listing:
Navy CLEAN UST Program Development (LANTDIV)
Closure Verification/MW Installation, SuperAmerica, Ohio and Pennsylvania
UST/AST Inventory Management, RIDC, Pennsylvania
UST/AST Remediation Program Development and Implementation, USX Homestead Works, Pennsylvania

PCB Management

- Projects involving PCB Management Activities related to steel mill, utility and industrial development clients, including: equipment inventory, quarterly inspections, notifications, annual reporting, and remedial task development (retrofill options, excavation operations, and analytical verifications).

Partial Project Listing:
PCB Management Program Development (140+ Transformers), USX Duquesne Works, Pennsylvania
PCB Management Program Development (180+ Transformers), RIDC, Keystone Commons
PCB Spill Cleanup Verification, Equitable Gas, Pennsylvania
PCB Spill Characterization, Cleanup Management, USX Homestead Works, Pennsylvania

Recycling, Resource Recovery and Waste Management

- Hazardous Waste Management Program Development, Waste Minimization Study, various USEPA submittals, Hussey Copper, PA
- Steel Mill Waste Management Inventory Compilation, Lorain, OH
- Paper/Metal Recycling Program Development/Implementation, PA
- Resource Recovery Facility Permitting, Pittsburgh, PA

Jeri L. Trageser

Geologist

EDUCATION: University of Pittsburgh
B.S., 1986

EXPERIENCE:

General Qualifications

Ms. Trageser serves as project geologist with over five years of progressively responsible experience in site investigation, and environmental assessment projects. She has managed and participated in numerous assignments involving field investigations and sampling, preparation of project plans, and waste characterization, including work at private industrial and Superfund hazardous waste sites. Additionally, Ms. Trageser has supervised approximately 100 well installations and 150 test borings, as well as three underground storage tank site closures for the Pennsylvania Department of Environmental Resources and the State of Missouri. She also served as the Remedial Investigation coordinator at an Ohio Superfund Site. She has completed 40 hours of health and safety training and is certified in first aid and CPR; she also has completed an eight-hour supervisor training program. Ms. Trageser's experience includes:

Groundwater/Soil Monitoring and Sampling

- Initiated a program to sample and analyze former tar decanter sludge mixing areas at two large steelmaking companies in Warren, Ohio.
- Prepared Project Plans for a Remedial Investigation of three sites at Marine Corps Base - Camp Lejeune, Jacksonville, North Carolina under the Navy CLEAN Program.
- Field mobilization and groundwater sampling activities. Experienced in Region V sampling protocols and Contract Laboratory Program (CLP) paperwork for an EPA (REM IV) landfill in Macomb County, Michigan.
- Assisted in sediment and soil sampling, test borings and installation of monitoring wells, well development, groundwater sampling. Also prepared geologic cross-sections for the Remedial Investigation Report. Experienced in the use of environmental monitoring equipment (HNu, OVA, CGI, HCN, pH and Specific Conductivity Meters). This project, for an EPA (REM III) funded RI, PCB Site in Boston, Massachusetts included over 200 hours in Level C protective equipment.
- Soil sampling, responsible for CLP Paperwork, health and safety monitoring using HNu photoionization detector at a PADER funded RI landfill in Allentown, Pennsylvania.
- Assisted in work plan preparation, supervised the drilling of test borings, monitoring wells and monitoring well installation, permeability testing, using the In-Situ Hermit for an EPA REM IV funded RI in Waskom, Texas. Assisted project manager in RI report preparation, including geologic cross-sections, CLP data management and preparation of data tables using LOTUS.
- Field team leader coordinating residential well sampling for the EPA National Pesticide Survey (nationwide program).

- Assisted in preparing work plans and final reports for U.S. Army Corps of Engineers, Buffalo District, DERA Program (four sites located in Minnesota, Wisconsin and Illinois). Field work included observing and logging monitoring well installation, well development, soil and groundwater sampling, as well as permeability tests.

- Directed installation of 35 monitoring wells for a major oil company in Pittsburgh, Pennsylvania involved in a property transfer.

- For a large real estate developer in Pittsburgh, Pennsylvania, conducted preliminary site assessment of more than 200 acre for a proposed shopping mall. Prepared letter report of site findings.

- Supported staff in groundwater sampling activities for an industrial client in Phoenix, Arizona.

- For a real estate developer in Pittsburgh, Pennsylvania, monitored and logged core from three drill rigs on 31 test borings, and constructed 8 - 10 geologic cross-sections for geotechnical report of proposed shopping center.

- Supported staff in air monitoring for asbestos at landfill in Berks County, Pennsylvania.

Ms. Trageser's other experience includes:

- Initiated a monitoring and recovery program for an Underground Storage Tank leak at the Czechoslovakian Embassy, Washington, D.C. Her proposal was submitted and approved by the U.S. Environmental Protection Agency, Parks Department and Embassy Officials.

- Prepared an environmental impact statement for a federal project in Tioga County, Pennsylvania (an approximately 300-gallon Pennsylvania crude oil spill).

- Served as on-site coordinator for an unknown corrosive liquid spill in Bellaire, Ohio. Responsible for coordinating clean up and disposal activities including a final report to the Ohio Environmental Protection Agency.

- Served as on-site coordinator for a trailer-load of battery acid spill in Uniontown, Pennsylvania. Responsible for activities involving clean up and disposal. Final report was prepared and submitted to the Pennsylvania Department of Environmental Resources.

- Initiated a program for hazardous materials disposal for the Chemistry Department and Print Center at Indiana University of Pennsylvania, Indiana, Pennsylvania.

- Developed decontamination procedure for a storage room of hazardous materials located at Carnegie Mellon University, Pittsburgh, Pennsylvania. Also provided guidance concerning the proper transport and disposal of several out-of-service transformers and capacitors.

- Site assessment for major oil company tank farm after holding pond overflowed, Petrolia, Pennsylvania.

PROFESSIONAL AFFILIATIONS

National Water Well Association - Association of Groundwater Scientists and Engineers
Association of Engineering Geologists
Association of Women Geoscientists

John Barone, P.G.

Senior Geohydrologist

EDUCATION: University of Delaware
Master of Science, Geology, 1978
Bachelor of Science, Geology, 1975
Bachelor of Arts, Philosophy, 1969

REGISTRATION: Certified Professional Geologist:
Indiana
North Carolina

EXPERIENCE:

General Qualifications

Mr. Barone has served as a professional geologist active in programs involving physical geology, geohydrology, geochemistry and geophysics for over 17 years. During that time, he has performed in various capacities, including: Principal Technical Investigator for development of general groundwater supplies and of protection for groundwater supplies threatened by salt-water intrusion along coasts and elsewhere; Project Manager and Project Director for multidisciplinary scientific and geotechnical programs addressing contaminated environments related to Remedial Investigations and Feasibility Studies for action at Navy CLEAN, CERCLA, RCRA, UMTRAP, FUSRAP and USATHAMA sites; Project Manager and Project Consultant for major geoscience and regulatory response programs; and Project Director for preparation of environmental permit applications for large industrial operations.

His dominant specialization is in the field of environmental geology and engineering, and regulatory affairs, although he also has considerable experience in traditional geologic practices (particularly in the development and protection of groundwater supplies) and in engineering geology. During his career, he has performed investigations of and provided site management for interdisciplinary scientific and engineering programs concerning the presence and effect of hazardous chemicals and radioisotopes in ground and surface waters, and in soils. His representation for consultation and technical services includes a variety of clients: Large and small industrial corporations; federal and local governmental administrations; legal firms and regulatory agencies; and nuclear and conventionally fueled power stations. These services range through preparation of programs for regulatory compliance, design of remedial action programs, technical Quality Assurance/Quality Control, design and evaluation of secure (chemical and radiological) and sanitary landfills, evaluation of groundwater resources, and precision investigation of natural and artificial subsurface structures for geotechnical stability. His responsibilities extend across all phases of projects, beginning with the preparation of the technical program and budget, and continuing through the detailed execution of the program to the preparation and presentation of the final report, both to the client and to any government agency concerned with the program. The major emphasis of this practice continues its focus on field investigation and the development of environmental response, based on the results of those investigations.

Contaminant Investigation and Remedial Design

<u>Responsibilities</u>

Technical QA Officer for Navy CLEAN site investigations; Principal Technical Investigator, Project Manager and Principal Author for CERCLA and RCRA programs of site characterization and of investigation for engineering design for remedial action involving contamination by inorganic and synthetic organic compounds; participation requires extensive interaction with various disciplines as the coordinator and executant of the project administration and the technical program, including performance of the investigation leading to characterization of the environment, engineering design and preparation of the various documents controlling the program and reporting its findings; these disciplines include geology, geohydrology, geochemistry, geophysics, geotechnical engineering, analytical chemistry, toxicology, and site health and safety

Major Programs

- U.S. Navy: Various Stations - Principal Investigator for site investigations and preparation of responses at facilities adversely affected by hazardous materials.

- U.S. Navy: Various Stations - Technical QA Officer for environmental investigations performed by Baker, Roy F. Weston, Inc., and Foster Wheeler Enviresponse, Inc., under the Navy CLEAN Program.

- Clean Sites, Inc.: MSGS Superfund site - Principal Geologist and Principal Site Investigator for final remedial design and implementation at a site characterized by inorganic and organic contamination of the groundwater environment, dealing with the industries principally responsible for the remedial action

- USX/USS: Fairfield Works - Project Manager and Principal Investigator for a multi-phase compliance program dealing with groundwater contamination around a closure area for disposal of organic and inorganic chemical compounds

- USX/USS: Clairton Works - Project Geologist and Principal Investigator for a multi-disciplinary geologic and engineering implementation of closure of a disposal area, including geotechnical characterization of the construction area and characterization of the groundwater environment contaminated by organic compounds

- USX/USS: Gary Works - Investigating Geologist for siting of a slag fill area and for dredging operations of an adjacent river

- USX/USS: Various Locations - Project Geologist for a variety of RCRA permit applications and compliance programs

- Bethlehem Steel: Bethlehem Plant - Principal Investigator and Project Manager for Clean Streams investigations of RCRA closure systems associated with contaminated groundwater

- Bethlehem Steel: Various Locations - Project Geologist for closure of disposal facilities adversely affecting groundwater quality; site characterization of groundwater contamination deriving from manufacturing and disposal operations

- Buckeye Pipeline: Fairfield, Pennsylvania - Principal Geologist for groundwater investigation and remediation of a catastrophic fuel spill, including the geotechnical engineering response

- LTV Steel: Aliquippa Plant - Project Geohydrologist for examination of the effectiveness of groundwater recovery by pumping of a contaminated regime

- Celanese Fibers: Various Locations - Project Consultant for Geohydrology and Principal Author for CERCLA Remedial Investigations and Feasibility Studies of extensive contamination by inorganic and synthetic organic compounds associated with chemical manufacturing

- Department of Energy: Oak Ridge National Laboratory - Project Consultant for Geohydrology in assessing groundwater quality adversely affected by plant disposal operations

- Department of Energy: Canonsburg Site - Site Manager for final, multidisciplinary investigations leading to remedial design and implementation of corrective action at a low-level radiation site affecting soils and groundwater quality

- Department of Energy: Largo Site - Project Consultant for Geohydrology characterizing the groundwater regime at a low-level radiation site and developing the remedial response measure of groundwater extraction and treatment

- US Army Corps of Engineers: Various Locations - Project Geohydrologist for characterization of groundwater environments degraded by creosote disposal at wood-processing sites

- General Electric: Hudson River - Site Manager for groundwater and surface water investigations of degradation by PCB releases during manufacturing and disposal

- United State Environmental Protection Agency, Region III: Geohydrologist for Regional RCRA compliance programs

- New Jersey Department of Environmental Protection - L&D Facility - Project Geohydrologist for site characterization of a State Superfund Remedial Investigation

- Pennsylvania Department of Environmental Resources - Berks Site - Project Geohydrologist for characterization of aquifer parameters leading to remedial design at a State Superfund Site

- Pennsylvania Department of Environmental Resources - GTAC: Various Locations - Project Consultant for Geohydrology for various State Superfund locations dealing with groundwater resources and contamination

Client Representation

- USS Division of USX:	various locations
- Bethlehem Steel:	various locations
- LTV Steel:	Aliquippa Plant Massillon Plant
- Clean Sites:	MSGS Site, Elkton, Maryland
- DuPont:	coastal Virginia
- Upjohn Pharmaceuticals:	western Michigan
- Celanese Fibers Operations:	various locations
- Eastman Kodak:	eastern Tennessee
- EM-S/MCB:	southern Ohio
- Aristech:	Haverhill, Neville Island
- Morton-Thiokol:	Plumsted CERCLA Sites
- Northern Petrochemical:	southern Illinois
- General Electric/NYDEC:	upstate New York
- Peoples Gas:	southern Florida

- Florida Power and Light: .... southern Florida
- NYS Electric and Gas: .... Finger Lakes, New York
- General Electric/DOE-FUSRAP (weapons): .... western Florida
- National Lead/DOE-UMTRAP (research): ..... western Pennsylvania
- DOE: .... Oak Ridge, Paradox Basin
- US Army, Corps of Engineers: .... various locations
- Marathon Oil: .... eastern Michigan
- CPS Chemical: .... coastal New Jersey
- Colonial Pipeline: .... central Virginia
- Buckeye Pipeline: .... western Pennsylvania
- Freeport Mineral: .... southern Louisiana
- Square D: .... western North Carolina
- RJ Reynolds: .... western North Carolina
- USEPA: .... various locations
- Pennsylvania DER-GTAC: .... various CERCLA locations
- Illinois DEM: .... central Illinois
- New Jersey DEP-CERCLA: .... L&D site, Berks site
- B.F. Goodrich: .... eastern Pennsylvania
- Champion Spark Plug: .... eastern Pennsylvania
- Cessna Aircraft: .... northern New Jersey
- IBM: .... eastern New York
- Maxwell House: .... coastal New Jersey

Environmental Audits

Responsibilities

Preparation of preliminary environmental audits of soils and groundwater for purchase and sale of industrial properties

Client Representation

- Carrier: .... various locations, Georgia
- Bridgestone/Firestone: .... various locations
- TLI: .... South Carolina
- USPCI: .... northern Pennsylvania
- Goodyear: .... eastern Ohio
- Pennsylvania Power and Light: .... Pennsylvania
- Post Properties: .... central Georgia

Groundwater Supply

Responsibilities

Traditional geohydrology services (not related to contamination) for municipal water supplies

Client Representation

- Fairfax County, Virginia
- Holland Township, New Jersey
- New Jersey Department of Natural Resources, various locations

- Stanhope, New Jersey
- Elizabethtown Water Company, New Jersey
- Delaware Department of Water Resources, various locations
- Delaware Geological Survey, various locations
- Collegeville, Pennsylvania
- Longwood Gardens, Pennsylvania

Groundwater Protection

Responsibilities

Design and conduct investigations of salt-water intrusion in coastal zones; design and implement protection programs for groundwater resources threatened in the coastal zone.

Client Representation

- Sussex County, coastal Delaware
- SME, coastal Georgia and South Carolina
- DER - Biscayne Aquifer, Florida
- Naples, Florida

Geotechnical Structure and Groundwater Programs

Responsibilities

Design and implementation of programs for subsurface protection of Category I structures at a nuclear power station; geologic and structural geologic analysis of rock stability for construction; visual investigations of exposed and underwater dam and saddle-dike structures

Client Representation

- Davis-Besse NPS: northern Ohio
- Convention Center/West Way: New York City
- Merrill Creek Dam: western New Jersey
- New Jersey Department of Natural Resources - Artificial Lakes
- Greater Pittsburgh International Airport: geotechnical exploration for construction

Additional Technical Qualifications

Hazardous Site Investigation Course - 40-Hour
Hazardous Site Management Qualification - 8-Hour
Cardiopulmonary Resuscitation Course - Red Cross
Basic First Aid - Red Cross
Private Pilot (ASEL): Federal Aviation Administration
SCUBA (Basic): PADI

Melissa C. Davidson

Community Relations Specialist

EDUCATION: Allegheny College
BS, Environmental Science, 1989
BA, English, 1989
Minor, Geology, 1989

EXPERIENCE:

Ms. Davidson's experience in the area of Community Relations spans project management to technical tasks. She has researched and prepared Community Relations Plans (CRPs) at a variety of Department of Defense (DoD) Activities, and has conducted the required community interviews with residents and public and elected officials in support of each CRP. She has written, designed and produced Site Information Brochures, Slide Shows, Site Information Photograph Albums and Fact Sheets. Her community relations services are designed to comply with DoD and EPA guidance requirements. Ms. Davidson has acted as the project manager for many of these jobs.

In addition to community relations services, Ms. Davidson also provides technical support for a variety of environmental management projects, including site reconnaissance and field sampling programs.

Community Relations and Marketing Projects

- Prepared the CRP, Slide Show, Site Brochure and Site Information Photograph Album for a National Priorities List (NPL) facility.
- Currently preparing the CRP, Slide Show, Site Brochure and Site Information Photograph Album for five other DoD facilities, including an NPL site.
- Currently researching and compiling Administrative Record files for fifteen DoD Activities in accordance with EPA and DoD guidance.
- Compiled a detailed photo album of site activity progression of a Superfund site for distribution to the client and regulatory agencies.
- Researched, compiled, designed and managed imaging of slides for various presentations covering topics from the Clean Air Act Amendments to landfill design.
- Researched, wrote, edited and produced brochures, newsletters, project briefs and <u>Qualifications and Experience</u> packages for five branch offices of an environmental engineering firm.

Project Experience

- Currently involved with the field sampling program for residential wells and surface water and sediments at a school. Involvement will include coordinating the field work with the school official and residents, and media sampling.

- Involved with the site reconnaissance of a facility in Puerto Rico. Will be a member of the field team, sampling media in a variety of locations including a mangrove swamp and jungle.

- Performed the field work and research involved to organize a PCB management program for several large, idled and partially idled steel making facilities. Located and classified transformers and capacitors; inspected units as necessary; complied with annual reporting requirements and outlined procedures for proper maintenance and disposal options.

- Conducted site assessments of various steel making facilities and other industrial sites to determine possible liabilities for property transfer and acquisition purposes. Scope of services included initial field investigation, document research, interviews and media sampling. Final reports also included suggested remedial efforts, as necessary.

- Participated in the geological investigations of a landfill Permit to Install (PTI) for an 85-acre site in Ohio. Contributed to mapping efforts and reviewed mapping of landfill design with respect to hydrogeology concerns. Constructed oil and gas well information map from public information and area resident surveys.

- Involved in various stages of the RFI for an integrated steel facility. Researched and compiled the RCRA Facility Investigation Task 1 as required. Scope involved, aside from information gathering, comparing the state pre-defined Solid Waste Management Units (SWMUs) with the company-defined SWMUs in light of effects to all media and to the community. Also involved in the tasks II and III submittal preparation.

Richard P. Aschenbrenner

Engineer

EDUCATION: University of Pittsburgh
BS, Civil Engineering, 1987
Pennsylvania State University
BS, Geoscience/Geology, 1984

REGISTRATION: Engineer-In-Training, 1989

EXPERIENCE:

General Qualifications

Mr. Aschenbrenner specializes in geology, hydrogeology, groundwater flow and contaminant transport modeling. His responsibilities include performing environmental and subsurface investigations, interpretation of geologic, hydrogeologic and transport data, aquifer testing, design of groundwater monitoring and extraction systems. Some of his specific experience includes:

Groundwater and Transport Modeling

- Development and application of proposed fossil fuel combustion residue disposal site performance prediction guidelines for the Utilities Solid Waste Activities Group. Guidelines for implementation of a performance prediction procedure were presented to USWAG, including the requirements for waste characteristic, hydrogeological, geochemical, meteorological, and geotechnical data collection. The use of these guidelines was illustrated through application to two demonstration cases. These demonstration cases were designed to integrate numerous compatible groundwater flow and transport computer models to predict site performance and to aid facility design.

- Reviewed the capabilities and limitations of thirteen groundwater flow and transport models. The review included an overview of groundwater hydraulics and contaminant transport processes and preparation of a report evaluating each of the models.

- Application of performance prediction guidelines via water balance, geochemical, groundwater flow, and solute transport modeling to determine the appropriate level of geotechnical design for fly ash, bottom ash and FGD sludge disposal facilities in Illinois. An integrated modeling approach was developed in which hydrologic balance and geochemical models were used in concert to estimate leachate quality and quantity. These estimates then were input into groundwater flow and transport models to predict potential groundwater impacts. This integrated approach also was used to investigate the effects of varying selected facility design parameters and hydrologic characteristics on groundwater quality.

- Evaluated ammonia contamination of a groundwater aquifer resulting from coking operations. The project involved placement, inspection and sampling of monitoring wells, the analysis of hydrogeologic and chemical data and the application of a contaminant transport computer model to predict contaminant movement and assess and implement remedial alternatives.

- Applied a solute transport model to evaluate the potential retardation and dispersion effects resulting from blending soils contaminated with low level radioactive materials with uncontaminated soils.

- Performed a flow path and capture zone analysis to develop the operating parameters of a groundwater extraction and containment system. A conceptualized representation of the site, based on data collected from a site investigation, was used as input into a computer model. The model then was used to develop an optimal groundwater containment system.

Technical Review

- Performed a technical review of the Welsh Road/Barkman Landfill Remedial Investigation. The review resulted in the re-interpretation of field geologic data and pump test results and the preparation of a groundwater summary report.

- Oversight of a NYSDEC Phase II site investigation at a coke plant in northwest New York State. All on-site activities and procedures conducted by the state's prime contractor were documented; groundwater, surface water, sediment, and tar samples were collected; and a report critiquing the prime contractor's field investigation was prepared for the property owner.

- Prepared a detailed, section-by-section technical review and comments of proposed Ohio EPA solid waste regulation for two separate industry groups. Continuing technical review following the development of the regulations is being provided to the clients..

- Technical review of the progress and approach of a Maine Department of Environmental Protection site investigation. The review resulted in suggestions and methodologies for focusing and streamlining the investigation and implementing interim remedial response actions.

- Participated in a preliminary environmental, safety and health audit of the Department of Energy's Pittsburgh Energy Technology Center.

Environmental Site Investigation, Remediate Investigations, and Feasibility Studies

- Principal investigator for the Struthers Wells/Ernst Steel Site Investigation under the Pennsylvania Hazardous Site Cleanup Program. Activities included preparation of detailing sampling and analysis, quality assurance, and health and safety plans, oversight of all field activities, data management, evaluation and analysis, and preparation of a site investigation report documenting field activities, analytical result, conclusions and recommendations.

- Analyzed geologic, hydrogeologic, and geophysical data as part of a remedial investigation for a superfund site in eastern Pennsylvania - developed aquifer testing and analysis procedures. On-site activities included aquifer testing, groundwater and surface water sampling, oversight of a geophysical investigation, and demobilization from the site.

- One of the primary authors of a Remedial Investigation/Feasibility Study for the Berk's Sand Pit Superfund site in eastern Pennsylvania. The FS presented designs for a groundwater extraction/treatment and reinjection system, surface water controls, sediment excavation, and a water supply system.

- Principal investigator for the Welsh Road/Barkman Landfill Feasibility Study. The FS presented designs and evaluations of numerous remedial actions including construction of a landfill cap, groundwater extraction and treatment, and the expansion of an existing public water supply system.

- Assisted in preparing the conceptual design and cost estimate for the Maryland Sand, Gravel and Stone superfund site. Principle activities included conducting a detailed QA review of the hydrogeologic site investigation and proposed extraction trenches and wells, and assisting in cost development for a groundwater extraction and treatment system.

- Assisted in the preparation of a focused feasibility study for the Beals Battery Site in western Pennsylvania. The FFS considered containment, incineration, and resource recovery technologies for lead contaminated soils.

- Performed extensive soil sampling and analysis to determine the extent of contamination from the unregulated disposal of coke oven gas pipeline residue. Each of seven disposal areas were characterized and volumes of COG pipeline residue were calculated.

- Performed tracer study investigations at mine spoil and refuse piles to determine groundwater flow paths, groundwater velocities and rates of contaminant transport.

- Participated in drilling inspection, soil sampling, monitoring well installation and preparation of the conceptual design report for the Arcanum Iron and Metals Superfund site in western Ohio.

- Operation and maintenance of a groundwater extraction system adjacent to a coke plant in southwestern Pennsylvania.. Collected tar samples and weekly groundwater samples, performed weekly estimates of the amount of contaminants removed form the system and tracked the transport of contaminated water to a nearby treatment facility.

PROFESSIONAL AFFILIATIONS:

American Society of Civil Engineers
American Geophysical Union
National Waterwell Association

ADDITIONAL QUALIFICATIONS

Site Health and Safety Course for CERCLA Investigations (40-hour course)

PUBLICATIONS

Aschenbrenner, R.P., G.D. Gumtz, and J.A. Freitag. "Coal Combustion Waste Disposal Design Factors - Their Influence on Groundwater Impacts." paper presented at the Air and Waste Management Association Conference. June 1990.

Barbara J. Cummings

Industrial Hygienist

EDUCATION: Indiana University of Pennsylvania
B.S., Environmental Health, minor in Safety Sciences, 1987

CERTIFICATION: EPA AHERA Certified:
Asbestos Abatement Supervisor
Designer
Building Inspector
Management Planer

OSHA HAZWOPER Certified:
40-hour Training
8-hour Supervisory Training
First Aid/CPR Training

EXPERIENCE:

General Qualifications

Ms. Cummings has broad industrial hygiene, environmental compliance, and safety experience in the manufacturing and consulting environment. Prior to joining Baker Environmental, Inc., she was employed by a Fortune 100 Manufacturing Company as an Industrial Hygienist, Health and Safety Supervisor, and Production Supervisor. As an Industrial Hygienist and Health and Safety Supervisor she was responsible for an in-house asbestos maintenance program, all industrial hygiene, environmental and safety programs related to OSHA and RCRA compliance. She also served as a Production Supervisor with the same company in their chemical department. In this position, she was responsible for the effective operation of the facility in the production of furfural, in additional to maintaining a safe and healthful work environment.

Ms. Cummings is an EPA AHERA Certified Asbestos Abatement Supervisor, Designer, Building Inspector, and Management Planner. She has attended seminars on hazardous waste site analysis and community right-to-know and has completed 40-hour training and 8-hour supervisory training under OSHA Standard 29CFR 1910.120. She has also worked with several local communities in areas related to safety and the environment.

Industrial Hygiene

- Reevaluated and revised plant Respiratory Protection Program including selection and use of equipment, qualitative fit-testing, program compliance, and training.
- Conducted noise surveys to evaluate employee exposure to new/redesigned packaging lines and process equipment.
- Evaluated Hearing Conservation Program, in an effort to enforce non-compliance areas through education and training.
- Conducted heat stress monitoring to evaluate employee safety in hot-processing environments.

- Routinely monitored employee exposure to grain dust, phosphine gas, and laboratory solvents.
- Compared capture velocities for laboratory hoods and LEV systems to evaluate OSHA and ANSI compliance.
- Conducted audiometric exams under the supervision of a certified audiometric technician.
- Completely revised plant Hazard Communication Program, including: rewriting the current policy; developing a training video for plant employees; managing MSDS inventory to control chemical use; and implementing a plant-wide MSDS control program.
- Conducted experimental area and employee air monitoring for the carcinogenic bacteria aflatoxin, found in stored grains.
- Responded to employee complaints on a regular basis to ensure a positive approach to a safe and healthful work environment.
- Responsible for evaluating personal protective equipment uses, to determine applicability to work situations.
- Worked with management and supervision to develop a Job Safety Analysis for all facility job postings.
- Conducted departmental safety audits to evaluate OSHA compliance.
- Responsible for conducting accident investigations and making recommendations for preventing future accidents.
- Worked with plant contractors to maintain safe work practices according to plant policy.
- Redesigned employee work stations, including training, to improve ergonomic design and reduce injury.
- Worked with plant safety committee to resolve employee concerns.
- Responsible for conducting an extensive air monitoring program that monitored ambient perimeter locations surrounding a coal tar waste remediation site with the results of these analyses being entered into a health risk assessment model designed specifically for the project. Air monitoring concerns included volatile organic compounds (VOCs), polynuclear aromatics (PNAs), and selected metals.
- Responsible for developing numerous Health and Safety Plans as specified under OSHA Standard 29 CFR 1910.120 for Site and Remedial Investigation Activities under CERCLA for the Navy CLEAN Program.

Asbestos Program Management

- Served as the program manager for an extensive in-house asbestos maintenance program, and directed trained employees in the removal and maintenance of asbestos.
- Served as project manager during large-scale abatement projects which included evaluating contractor bids, serving as an on-site industrial hygienist and assuring regulatory compliance. Remained "on-call" for emergency asbestos removal.

- Initiated the removal of asbestos-containing material (ACM) product inventory to reduce employee exposures.

- Conducted routine air monitoring to evaluate employee exposures and determine background levels plant-wide.

- Conducted extensive asbestos building inspections for public, private, and governmental organizations locally and abroad, that culminated in the development of project design specifications, work specifications, and overall program responsibilities.

- Worked with management personnel in developing the Department of Defense Dependents Schools' (DODDS) AHERA reinspection format.

- Served as the on-site industrial hygienist for several small- and large-scale asbestos abatement projects.

Environmental

- Responsible for submitting applications for permits to install (PTI) and permits to operate (PTO) to local and state agencies for dust collection equipment emitting particulate to the ambient environment.

- Responsible for SARA Title III compliance at a manufacturing facility and the submittal of annual reports.

- Supervised the removal of hazardous waste, i.e., PCBs, ignitable solvent wastes and mercury capacitors.

- Assisted in the development of a manufacturing facilities SPCC plan.

- Revised/reevaluated NPDES permit to submit for renewal to the state agency.

- Served as the "contact person" at a manufacturing facility for all environmental concerns.

- Developed a site Health and Safety Plan under OSHA Regulation 29 CFR 1910.120, for hazardous waste operations and emergency response, to identify hazards during the remediation of a soil/groundwater fuel-contamination site.

Production Supervision

- Responsible for the efficient operation of a chemical facility in the production of furfural.

- Interacted with labor and management on scheduling, labor and safety issues to maintain an efficient operation.

- Conducted safety training/audits for departmental employees.

- Remained actively involved in ergonomic issues with the department, constantly striving to improve work conditions.

Training

- Conducted a variety of training for labor and management personnel in the areas of:

  - -- Asbestos Management Program
  - -- Respiratory Protection
  - -- Pesticide Application
  - -- Hearing Conservation
  - -- Safety Orientation
  - -- Job Safety Analysis Development
  - -- Accident Investigation

- Conducted training sessions in multiple manufacturing facilities as a means of educating concerned personnel on a broad-range of asbestos issues.

- Developed and implemented a hazard communication training video directed towards employees at a specific plant location.

PROFESSIONAL AFFILIATIONS:

American Industrial Hygiene Association
American Society of Safety Engineers

Donald C. Shields

Geologist

EDUCATION: University of Nebraska
M.S., Geology, 1987
Pennsylvania State University
B.S., Geosciences, 1985

TRAINING: Health and Safety Training, 1988
Annual 8-Hour Retraining, 1989-1991
8-Hour Supervisors Health and Safety Training, 1991

EXPERIENCE:

General Qualifications

Mr. Shields is a Geologist in the Navy CLEAN Program at Baker Environmental, Inc. He has participated in a variety of environmental site assessments, RI/FS, and remediation projects at several sites, including CERCLA and RCRA facilities.

Prior to joining Baker Environmental, Inc., Mr. Shields served as a hydrogeologist at Hart Environmental Management (1987-1989) and Remcor, Inc. (1989-1991).

Soil Remediation

- Served as Assistant Project Manager for closure of five underground storage tanks and investigation of a leach field associated with an inactive paint recycling system at an industrial facility in New Jersey. Coordinated and supervised the disposal of 300 cubic yards of lead and cadmium contaminated soil.

- Served as Assistant Project Manager for closure of a 30,000-gallon underground storage tank at an industrial facility in New Jersey. Coordinated disposal of 100 cubic yards of petroleum contaminated soil.

Groundwater Remediation

- Served as Assistant Project Manager for a groundwater remediation project at an industrial facility in Western Pennsylvania. Supervised installation of a groundwater recovery and treatment system.

- Served as Project Hydrogeologist for a groundwater monitoring and remedial investigation in Western Pennsylvania. Investigation activities included installation of recovery and monitoring wells; installation and operation of a dual pump free product recovery system; performance of aquifer tests; and quarterly groundwater sampling.

- Utilized groundwater computer models to evaluate remedial options for sites in New Jersey and Pennsylvania.

Site Assessments and Remedial Investigations

- Supervised installation of groundwater monitoring wells at Naval and RCRA facilities in Puerto Rico.
- Served as field team leader for a groundwater monitoring investigation as part of a permit compliance for a RCRA facility in West Virginia.
- Served as field team leader for a groundwater assessment at an inactive landfill in Central Pennsylvania.
- Supervised the installation of groundwater monitoring wells and conducted aquifer tests as part of a focused FS at a CERCLA site in Vermont.
- Supervised the installation of groundwater monitoring wells and conducted a soil gas survey as part of an RI/FS at a CERCLA site in Ohio.
- Performed oversight of an RI/FS at a CERCLA site in Western Pennsylvania.
- Supervised installation of groundwater monitoring wells at a mixed (hazardous/low level radioactive) waste site in Western Pennsylvania.
- Utilized U.S. Geological Survey (USGS) two-dimensional solute transport computer model (MOC) to predict potential leachate migration from a proposed landfill in New Jersey.
- Supervised the installation of piezometers and monitoring wells into and through a mine void at a landfill site in Western Pennsylvania.

PUBLICATIONS

Shields, D. C., and Uhlman, K., 1991, Volatile organic compound transport in the subsurface: a case study: Hazardous Materials Control Research Institute, Northeast Conference Proceedings, pp. 243-247.

Richard P. Dabal

Senior Environmental Scientist

EDUCATION: University of Wisconsin
B.S., Environmental Science, 1980

General Qualifications

Mr. Dabal is an environmental scientist with eight years experience in a variety of environmental fields. His experience includes site supervision, project management, proposal evaluation, report writing, emergency response, coordinating sampling events, data evaluation and interpretation. The majority of this work has been related to site remediation programs involving excavations, drum removals and underground storage tank (UST) removals.

Mr. Dabal is currently responsible for providing project management and technical support for Basic Engineering Services Group.

Project Experience

- Project Manager responsible for PCB Spill investigation at a Naval Air Station.
- Project Manager responsible the the sampling and characterization of hazardous unknowns at the Naval Air Station, Island of Bermuda.
- Technical support in preparation of Basic Ordering Agreements for surveying and drilling services.
- Field Supervisor of multiple sampling events (Roosevelt Roads Naval Air Station, Puerto Rico).
- Site Supervisor for the remediation of Superfund site in northern New Jersey, involving Radon contaminated soil.
- Field Supervisor for the mitigation of potentially explosive materials at an abandoned chemical warehouse in northern New Jersey.
- Site Supervisor for emergency services involving a 4,000 gallon oil spill into trout stream that also provided water for adjacent farms.
- Duty Officer for emergency services of State Department of Environmental Protection, State of New Jersey.
- Field Supervisor for quarterly sampling events at several Superfund sites in the State of New Jersey.
- Office support for the evaluation of bid proposals and data evaluation.
- Provided technical guidance and field supervision for the removal of obsolete pharmaceuticals and medicines from the State of New Jersey residential treatment facilities.

- Site Supervisor for the closure of an abandoned landfill in Hudson County, New Jersey.
- Field support for the Dioxin Task Force under the Field Investigation Team, USEPA, Region II.
- Field Supervisor for the installation of monitor wells at several state Superfund sites in the State of New Jersey.
- Field Supervisor for the removal of USTs at several active manufacturing facilities.
- Field Supervisor for the removal of mustard gas from an abandoned chemical warehouse in northern New Jersey.

Training Certifications

- Certified Installer for Owens Corning Fiberglas tanks
- Advanced First Aid/CPR
- Hazardous Waste Operations and Response Supervisor Manager [29 CFR 1910.12]
- Hazardous Waste Operations and Emergency Response [29-CFR 1910.120]
- Five years in the local fire service: trained in Heavy Rescue, Haz-mat Response, Site Control, Chlorine Gas Emergencies

Peter A. Monday

Scientist

EDUCATION: Pennsylvania State University
B.S., Environmental Resources Management, 1989

Pennsylvania State University
Independent Study, 1989
Neutrification of Acid Mine Drainage and Reduction of Ferrous and Sulphurous Ions through the use of Varying Detention Soil Medium Cells

CERTIFICATION:

40-Hour OSHA Hazardous Waste Worker Training, 1990
16-Hour Hazardous Chemical Safety Training, 1990
16-Hour CPR and First Aid Training, 1990
16-Hour Air Quality Surveillance Training, 1991
8-Hour Waste Worker Refresher Training, 1991
8-Hour Site Supervisor Training, 1991

EXPERIENCE:

General Qualifications

- As a previous member of the Health and Safety Department, Mr. Monday has conducted Health and Safety training programs for fellow employees, developed a computer data base to track all employees medical and training records, and was responsible for calibrating and repairing all field monitoring equipment.

- As a Environmental Scientist with Baker Environmental Inc., Mr. Monday is responsible for initial procurement of field equipment for the Navy CLEAN Contract. Other responsibilities also include site investigation activities, sampling, and monitoring activities. In addition, Mr. Monday has experience in writing Health and Safety Plans, Verification Investigation Reports, and Implementation Plans and Fee Proposals.

Remedial Investigations

- In-Situ Treatment of Volatile Organic Contaminants - Mr. Monday directed In-Situ Treatment activities at a site in South Carolina. Other field operations included, Head Space Analysis, and soil and water sampling. Additional responsibilities were, on-site Health and Safety Officer, and daily progress meetings with the client. Field operations included using mechanical along with thermal processes to strip volatiles from the impacted soil. Head Space Tests were conducted several times on a daily basis as a judgement tool too see if samples could be taken for lab analysis. Once sample results were received from the lab and were under state guidelines a twelve inch layer of soil was excavated and stockpiled. Over 2,000 cubic yards of impacted soil were cleaned, excavated, and stock piled.

- Conducted Underground Storage Tank removal and remediation activities at an industrial site in Eastern Ohio. Operations included supervision of subcontractors and collecting soil samples.

- Supervised several Underground Storage Tank Testing projects at an industrial site in Eastern Ohio. Operations included programming and data interpretation.

- Conducted air monitoring activities at a site in Central Pennsylvania. Responsibilities included monitoring the exposure to employees during chemical sludge neutrification processes. In addition other responsibilities were operating and calibrating field perimeter air monitoring equipment to determine if the neutrification process was releasing contaminants downwind and/or off site.

- Conducted well development and well sampling activities at a site in Western Pennsylvania. Responsibilities included development, purging, and sampling of wells.

- Conducted manhole inspections for an inflow/infiltration study being conducted for United States Navy at Roosevelt Roads Navy Base in Puerto Rico.

Technical Qualifications

- In-Situ treatment of volatile organic contaminants - performed mechanical and thermal stripping of impacted soils at an industrial site in South Carolina.

- Soil Sampling - have conducted soil sampling on several projects. Some of the soil sample methods were TCLP, TOC, EPTOX, and TPH.

- Well Sampling - have conducted well sampling activities for the determination of groundwater contamination.

- Field Monitoring Equipment - proficient in calibrating and repairing Flame Ionization Detectors, Photo Ionization Detectors, and Combustible/Toxicity Meters.

- Underground Storage Tanks (USTs) - supervised the removal of USTs and the remediation activities that followed.

- Computer skills - proficient with IBM compatible software, including Lotus, Word Perfect. Familiar with Quatro Pro, dBaseIV, and some computer modeling.

PROFESSIONAL AFFILIATIONS:

Member of the Pennsylvania Association of Environmental Professionals

John E. Zimmerman

Assistant Geologist

EDUCATION: Kansas State University
M.A., Applied Environmental Science, 1991
Clarion University of Pennsylvania
B.S., Geology, 1989
B.S., Geography, 1980

EXPERIENCE:

General Qualifications

Mr. Zimmerman is an Assistant Geologist in the Navy CLEAN Program at Baker Environmental, Inc. He provides support for site investigations, hazardous waste management projects and underground storage tank evaluations. Mr. Zimmerman's areas of expertise include environmental science include geomorphology, hydrogeology, satellite monitoring of the environment and geoprocessing, and examination of environmental issues.

Mr. Zimmerman has conducted research in satellite monitoring of the environment and geoprocessing. This research included a study of data sources and computer-based systems such as multispectural imagery, CAD and GIS software programs/applications. He has used microcomputer to conduct computer modeling/ simulation of geologic assessments such as subsurface structural control, soil resources, vegetation type, water resources, and land use management when documenting environmental analysis on and below the earth's surface.

Mr. Zimmerman has examined environmental issues including water quality and quantity in arid lands, desertification, land use management, site assessment criteria and impact studies, and surface hydrology/vegetation change on a regional basis.

Prior to joining Baker Environmental, Inc., Mr. Zimmerman served as a Graduate Teaching Assistant at Kansas State University where he instructed a laboratory course in Environmental Geography and supervised all laboratory work. Earlier, as a Geophysicist's Assistant for Texaco; he supported processing and review of seismic sections for offshore oil production in the Gulf of Mexico. He also executed quality plots and CVSTACKS/CVGATS, created stack and migration programs for execution, established deep-sea macro to determine migration velocities when changes occurred in the water bottom, implemented DMO in areas of conflicting dip, and executed intersec macro for tie line annotation. He also served as a cartographer, conducting geological and geophysical drafting.

PROFESSIONAL AFFILIATIONS

Sigma Gamma Epsilon (Earth Science Honor Society)
Gamma Theta Upsilon (Geography Honor Society)
American Association of Petroleum Geologists

HONORS

Outstanding College Students of America

David J. Martin

Assistant Geologist

EDUCATION: Indiana University of Pennsylvania
B.S., Geology, 1985

EXPERIENCE:

General Qualifications

Prior to joining Baker Environmental, Inc., Mr. Martin served as a technical representative for GeoSonics, Inc. (1987-1989) primarily responsible for seismic monitoring of ground vibrations at various blast sites on land and under water. Performed preconstruction surveys of structures and documented existing defects. Gained experience interfacing with property owners adjacent to blast sites. Assigned responsibility for maintaining an office in St. Thomas, United States Virgin Islands, monitoring ground vibrations and any structural damage from a pile during operation in the waterfront area. Compiled a voluminous record of data that was key to settling claims.

After GeoSonics, Inc., Mr. Martin was employed at Haley & Aldrich, Inc. He served as a technician working in both geology and instrumentation departments. With the former have worked on the Central Artery/Third Harbor Tunnel Project (CAT) for rock coring and soil sampling (split spoons and shelby tubes) installing pneumatic and vibrating wire piezometers and observation wells. Responsible for three drill rigs and boring logs.

For the instrumentation department, monitored site preparation and structural fill at Belvidere Middle School and NYNEX telephone building to assure all specifications for bearing surfaces were met. On the I-287 project in New Jersey, have had full responsibility for monitoring vibrations from production blasting to assure that peak particle velocity specifications are not exceeded, thereby endangering the integrity of the high pressure 30-inch Algonguin gas transmission line. Review blast pattern, orientation bedrock structures (i.e., joint sets direction) and maintain record of all blasts and scaled distances as a guide for the blasting contractor. Other projects included instrumentation monitoring of the seven floors below ground Post Office Square Garage and soil resistivity analysis at a J. C. Penney site in Massachusetts.

Mark E. Kimes

Civil Engineer

EDUCATION: Youngstown State University
B.S., Civil Engineering, 1991
Environmental Concentration

EXPERIENCE:

General Qualifications

Mark E. Kimes is a 1991 graduate of Youngstown State University. He comes from a rigorous engineering program which included a research assistant for water quality studies at Lake Milton Reservoir. He brings to Baker Environmental, Inc. his academic and practical training as well as his desire to apply these skills to environmental engineering projects.

- Sampled surface water at Lake Milton and performed various analyses in the laboratory. The analyses included various phosphorous tests along with dissolved oxygen, chlorophyll-a, suspended solids and turbidity.

- Assisted with soil borings and groundwater sampling at Oceana Naval Air Station for a PCB spill investigation.

- Very proficient with various computer software such as Quatro Pro, WordPerfect 5.1, FastCAD, DrawPerfect, Paradox and Marsh McBirney Floware flowmeter software.

- Assisted in a Inflow/Infiltration study on the sanitary sewer system at Roosevelt Roads Naval Station. Duties included inspecting approximately 900 manholes, installing Marsh McBirney Flo-Totes, and obtaining the data from the meters.

Professional Affiliations

American Society of Civil Engineers
National Society of Professional Engineers

Certifications

40-Hour Hazardous Waste Worker Training
8-Hour Hazardous Waste Supervisory Training
Standard First Aid/Adult CPR

Robert D. Rinowski

Geologist

EDUCATION: University of Texas
M.S., Geology and Geophysics, 1981
Winona State University
B.S., Geology and Mathematics, 1978

EXPERIENCE:

Mr. Rinowski has functioned as Project Manager on more than 30 projects involving geologic and hydrogeologic site characterizations, soil and groundwater assessments and monitoring, and RCRA and TSCA compliance issues. Some of these projects include:

- Management and closure of petroleum and hazardous materials USTs at five plant sites for a major industrial client. Closures were performed in-situ and by removal. Performed follow-up site characterization.

- Planned the closure of an UST site in Virginia contaminated with PCBs and listed RCRA wastes. The plan included the removal, decontamination, transport, and destruction of the USTs, mixed waste, PCB articles, and confirmatory sampling in accordance with EPA guidelines.

- Compliance monitoring of wastewater lagoons at a plant site in North Carolina. Evaluated the groundwater and surface water impacts posed by the lagoons with hydrogeologic mapping and water quality indicator parameter analyses.

- Evaluate three potential plant sites in Virginia for a major food products manufacturing company. Investigated potential residual contamination at the sites from the past application of sludge and agriculture chemicals, and the affects of adjacent manufacturing activities. Evaluated the compliance and capacity of local and regional raw water and wastewater treatment utilities to provide for needs of the clients planned facility.

- Project Geophysicist acquiring and evaluating surface and borehole geophysical data during the RI phase at a Superfund site in Virginia. Generated earth-models from resistivity sounding data with a commercially available computer program.

- Project Hydrogeologist in the FS phase of a Superfund landfill site in Virginia. Evaluated capping alternatives for the landfill simulation using the USGS MODFLOW groundwater flow modeling computer program.

REGISTRATIONS

Virginia #723
North Carolina #759
Tennessee #TN0528
Arkansas #698

Date of Hire:
Years with other Firms:

ROY F. WESTON, INC. RESUMES

PROFESSIONAL PROFILE

BARBARA JAKUB

Fields of Competence

Hydrogeologic and geologic site investigations; development and implementation of groundwater and soil investigations including: aquifer testing and interpretation; analysis of chemical data; supervision of drilling projects using coring, air rotary, and mud rotary.

Hazardous waste site projects, including sampling in all media for site assessments and extent of contamination, contractor monitoring, emergency response, air monitoring, and use of Level B and C personal protection.

Experience Summary

- Two years of experience in geological, hydrogeological subsurface site investigations, including evaluations of contaminant migration in unconsolidated aquifers; aquifer testing and evaluation; monitoring well installation in diverse geological situations; chemical data evaluation; aerial photograph evaluation; and report writing.

- More than two years of experience in hazardous waste site assessments and removals as a member of the U.S. EPA Technical Assistance Team which involved preparing groundwater, soil, drum, etc., sampling plans and performing the sampling; contractor monitoring on removal projects which included maintaining all necessary logs, air monitoring using all instruments, providing daily cost tracking, and writing removal summary reports.

- Assisted in compilation of the Pennsylvania tectonic map and determining the extent of oil and gas fields in western Pennsylvania. Fieldwork included preparing logs of drill core and high wall sections in order to estimate coal reserves.

Credentials

B.A., Geology — Temple University (1987)
Hazardous Waste/Health and Safety Training — WESTON
Certified Level C Site Health and Safety Coordinator
Certified in CPR and First Aid — American Red Cross

Employment History

1987-Present	WESTON
1987	ATEC Associates, Inc.
1984	Pennsylvania Department of Environmental Resources

BARBARA JAKUB
(continued)

Key Projects

RI Groundwater and Soil Investigation, Perth Amboy, NJ, Confidential Client, Project Geologist. Coordinated site activities for metals contaminated site including: soil borings, monitor well installation, surveying, groundwater sampling, surface water sampling, and graphics in the Geographic Information System (GIS). Also performed the aerial photograph review, chemical data interpretation and report writing.

Groundwater and Soil Investigation, Philadelphia, PA, Confidential Client, Geologist. Performed field work including: installation of monitor wells and soil borings, interpretation chemical data, report writing and making recommendations for remediation of a solvent contaminated site.

Site Assessment and Removal, Farmingdale, NY, EPA, Project Manager. Developed HSAP, sampling plan for representative sampling of 700 drums, coordinated laboratory data with CLP labs, oversaw contractors, coordinated Health and Safety for a Level B site, and put together community relations packages.

Site Assessment, Danna Estates, NJ, Project Manager. Performed groundwater sampling and tap sampling and reviewed a previous report to make recommendations for site remediation of Mercury contamination.

Environmental Assessment, U.S. Virgin Islands, EPA, Team Member. Conducted assessment of U.S.V.I. after Hurricane Hugo including site entry into a destroyed medical facility suspected of having radioactive contaminants, investigation of small quantity generators of hazardous waste, and sampling transformers for PCB using Chlor-in-Oil Kits and writing a report.

PROFESSIONAL PROFILE

JOHN F. NIST

Fields of Competence

Hazardous waste closure and permitting; site assessments; regulatory compliance, survivability studies; remedial operations; hazard predictions; training; protection and detection of nuclear, biological, and chemical (NBC) hazards; radiation protection; operations management; project management; systems management.

Experience Summary

- Over 6 years of experience working in the environmental field.

- Experience working with numerous government clients on RCRA Corrective Measures and Environmental Assessments. Closely interacted with federal, state, and local environmental agencies.

- Over 4 years of experience as a NBC warfare officer in the U.S. Army. Responsibilities included management, training, and direct supervision of NBC hazard detection, protection, and decontamination teams. Consultant on all NBC hazard-related matters. Conducted extensive environmental assessments and predicted environmental impacts of military operations.

Credentials

M.S., Engineering Technology and Systems Management with Environmental Option -- Murray State University (1988)
B.A., Biology -- Western Maryland College (1984)
M.S., Water Resources and Environmental Engineering -- Villanova University (in progress)
Hazardous Materials Response Operations Course -- WESTON (1990)
U.S. Army Chemical Officer Basic and Advanced Courses -- (1984 and 1988)
Top Secret Security Clearance -- U.S. Government (1986)

Employment History

1990-Present WESTON
1984-1989 United States Army

Key Projects

Resource Conservation and Recovery Act (RCRA) Closure Plans and RCRA Part A and Part B Permit Applications, Letterkenny Army Depot (LEAD), Pennsylvania, U.S. Army Corps of Engineers (USACE), Lead Project Scientist. Conducted historical document reviews, site inspections, and interviews. Prepared RCRA Closure Plans for numerous sites,

JOHN F. NIST
(continued)

Key Projects (continued)

and RCRA Part A and Part B Permit Applications for the entire facility. Responsible for the technical review and managed the production of 33 closure plans and RCRA Part A and Part B Permit Applications within a 4-month timeframe. Interacted with USACE, Pennsylvania Department of Environmental Resources and LEAD officials to resolve technical issues regarding closure plan and RCRA Part A and Part B Permit Application approval.

Groundwater Sampling Activities, Pennsylvania, Confidential Client, Lead Project Scientist. Conducted on-site groundwater sampling, including well purging, sample collection, equipment decontamination, packaging/chain-of-custody forms, and shipment of samples. Operated mobile activated carbon water filtration unit for treatment of purge waters. Coordinated with off-site property owners for sampling authorization.

Waste Site Characterization Study, Various U.S. Army Properties, U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), Lead Project Scientist. Evaluated storage and disposal practices for all hazardous materials and petroleum products. Work included: conducting historical background searches; obtaining data from local, state, and federal utility, engineering, and environmental agencies; collecting and evaluating data; conducting site visits and interviews; scoring sites using the Environmental Protection Agency's (EPA) Hazardous Ranking System (HRS) scoring model; summarizing potential hazards and producing technical reports.

Preliminary Assessments for Army Region III Docket Sites, Various U.S. Army Properties, USATHAMA, Lead Project Scientist. Conducted an extensive analysis of site operations, storage practices, contaminant pathways, and local receptors. Potential releases from hazardous material sites and their impacts on the environment were determined and documented. Project involved: review of existing information; conducting site reconnaissance; collecting data for EPA's newly revised HRS scoring model; prioritizing for site inspection; report preparation and documentation.

Environmental Field Operations Planning, Alabama, U.S. Army, Chemical Officer Advanced Course. Developed operation plans for working in hazardous environments. Lead numerous exercises in hazardous environments. Performed various operations including hazardous material assessment and decontamination in an environment contaminated with real nerve agents.

Hazardous Environment Operations, Kentucky, U.S. Army, Chemical Training and Operations Officer. Developed, performed, and managed extensive hazardous environment assessment, survivability, and remediation operations. Predicted hazardous areas through

JOHN F. NIST
(continued)

Key Projects (continued)

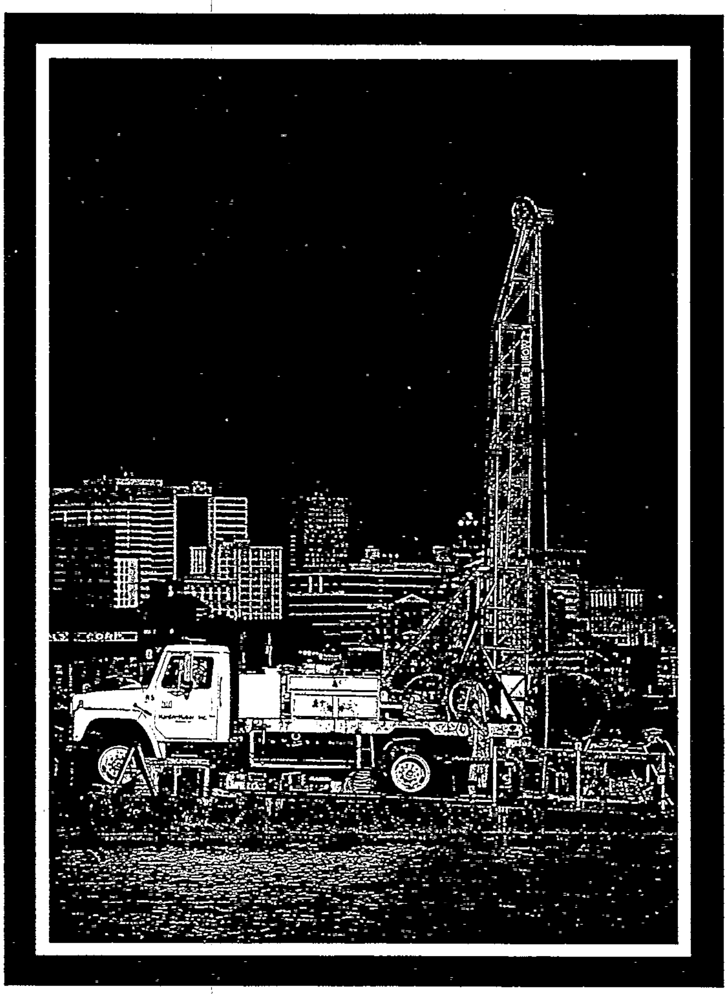
modeling and simulation. Inspected, operated, and maintained hazard detection and protective equipment for over 700 personnel. Developed aircraft decontamination techniques which were eventually adopted by the Army. Analyzed, reviewed, and approved all operation plans, or recommended changes to ensure that they were environmentally safe. Conducted economic analysis and detailed scheduling to ensure environmental projects were feasible.

Hazardous Environment Training, Kentucky, U.S. Army, Commandant of Forces Command Area NBC School. Administered and supervised the instruction of 600 students annually on Nuclear, Biological, and Chemical (NBC) hazard detection, avoidance, operations, and remediation. NBC shift leader at the Tactical Operations Center for the 101st Airborne Division (22,000 soldiers). Arranged proper disposal of hazardous toxic and radioactive materials as the Division Radiation Safety Officer. Served as chief of the Northeast region of the national nuclear warning and reporting collection network. Interpreted and implemented environmental policy directives from higher authority, establishing plans for their use. Developed and managed an installation-wide training program which improved the technical proficiency of all people working in the NBC field.

Hazardous Environment Field Operations, Kentucky, U.S. Army, Decontamination/Smoke Platoon Leader. Supervised, counselled, and scheduled activities for a 29-soldier unit with equipment valued in excess of $2 million. Deployed unit to the U.S. Military Academy to train cadets on NBC Defense proficiency. Managed project to modify smoke systems to reduce the amount of petrochemical ground contamination. Conducted comprehensive studies on hazard detection, identification, and protective equipment; recommended modifications to improve effectiveness. Ensured all activities complied with existing environmental guidelines and policies. Assessed the impact of activities on public safety and conservation of natural resources.

Hazardous Environment Operations, Kentucky, U.S. Army, Assistant Operations and Chemical Officer. Operated and managed the NBC Defense program. Served as Chemical and Nuclear Surety/Emergency Response Officer for a 2,400-man unit. Conducted operations in simulated hazardous environments. Inspected, operated, and maintained hazard detection and protective equipment for over 600 personnel. Identified and corrected NBC operational and maintenance problems. Developed and analyzed proposals for construction projects to minimize adverse environmental impacts. Managed a project to facilitate the fielding of new hazardous protective overgarments and their packaging configuration. Reviewed proposals and operation plans to identify areas where environmental problems existed or could arise.

HARDIN-HUBER, INC.



HHI

HARDIN-HUBER
INCORPORATED

Environmental And
Geotechnical Drilling
Specialists

HARDIN-HUBER
INCORPORATED

Letter Of Qualification

Gentlemen:

Since 1972, Hardin-Huber Inc. (HHI) has provided professional drilling services. Initially formed as Hardin Associates in 1972, the current Corporation was established in 1982 with the primary focus on environmental drilling.

We are licensed to drill in the states of Maryland, New Jersey, Delaware, Pennsylvania, North Carolina, South Carolina. We are also authorized to install wells in New York, Virginia, Kentucky, West Virginia and Massachusetts.

Hardin-Huber, Inc. currently operates twenty drill rigs throughout the east coast region. Our drilling capabilities include Hollow Stem Auger, Air Percussion, Tubex (ODEX), Air Rotary, Mud Rotary Wireline Coring and Packer Testing.

Each of our drilling crews meet the requirements of compliance with OSHA 1910.120. In addition to drilling crews, we can provide operators and excavation equipment for work in hazardous waste environments. We currently have 70 employees. We have on-hand Level"C" and Level "B" equipment, and our crews have experience drilling in these conditions.

If we can be of additional assistance please do not hesitate to contact me.

Sincerely,

HHI

Michael P. Willey
Vice President-Operations

MPW:wjh

Main Office
6720 Ft. Smallwood Road
Baltimore, Maryland 21226
301/789-5020
Fax 301/789-5029

Environmental And
Geotechnical Drilling
Specialists

Branch Office
Greensboro, North Carolina

HHI

HARDIN-HUBER
INCORPORATED

March 6, 1992

Baker Environmental, Inc.
Airport Office Park, Building 3
420 Rouser Road
Coraopolis, PA 15108

Attention: Tom Artman

Dear Mr. Artman:

HHI has provided drilling services under Level "B" respiratory protection on several projects over the past years.

Prior to 1989, the equipment used for Level "B" activities was SCBA'S or a Air Line Systems provided by others. In March of 1989, we purchased a Surviv-Air Cascade System from Air Power International capable of supporting three men in the hot zone for up to eight hours a day. Included in our system is 400 ft of air line hose, 4500# DOT cylinders, escape air units and low pressure warning bells.

At the conclusion of each use, our masks and escape packs are returned to Air Power for rebuilding and certification. The cylinders are evacuated, tested and recharged annually.

The following individuals have field experience using our own system:

NAME	PROJECT
Mark Fletcher	Lipari Landfill
George Smith	Lipari Landfill
Jeff Corron	Middletown Airfield
Don Willey	Middletown Airfield
William Kimes	Middletown Airfield
Richard Kimes	Middletown Airfield
Jay Corron	Middletown Airfield
Terry Mise	Middletown Airfield
Brian Van Doren	Dupont Richmond
Ben Fuller	Dupont Richmond

Main Office
6720 Ft. Smallwood Road
Baltimore, Maryland 21226
301/789-5020
Fax 301/789-5029

Environmental And
Geotechnical Drilling
Specialists

Branch Office
Greensboro, North Carolina

HARDIN-HUBER
INCORPORATED

In addition to the above individuals there are several other employees who have Level "C" experience as well as training in Level "B" personal protection equipment.

Very truly yours,

HHI

Richard Kimes
General Superintendent/
Health & Safety Director

NAVY CLEAN

Date Received: 3/11/92
Project Manager: TEA
CTO Number: 84
bcc: PRGM F (orig.): TEA; ST; JLT.

Subfile No.: 8

HARDIN-HUBER
INCORPORATED

SCOPE OF SERVICES

HHI is a contract drilling firm specializing in environmental and geotechnical drilling. We have the capabilities to handle a wide range of projects from one day jobs to the complex, multi-rig, long term projects.

HHI has established a reputation for providing quality work at competitive rates. We offer the following services:

* Monitoring wells
* Hollow stem auger drilling
* Rotary mud drilling
* Air rotary drilling
* Large diameter wells with Caisson rigs
* Recovery well
* Well abandonment
* Standard penetration test borings
* Rock coring
* Gas probes
* Offshore drilling
* Trenching, excavation, and test pits
* Continuous sample augering
* Instrumentation installation
* Packer pump testing
* Decontamination

HARDIN-HUBER
INCORPORATED

SCOPE OF SERVICES
(continued)

* In-house fabrication and welding shop

* Site restoration including equipment for on site drum transportation

* Recovery system construction

* OSHA trained crews

HHI currently maintains Twenty drilling rigs with various drilling capabilities. Additionally, we have thirty support vehicles to provide rapid and timely response throughout the region. Additional equipment includes All Terrain Vehicles (ATV's), tractor/trailers, an offshore drilling barge, excavation equipment, steam cleaners and air compressors. We maintain approximately two thousand feet of monitoring well casing and screen in stock along with a large inventory of related monitoring well materials.

HARDIN-HUBER
INCORPORATED

EQUIPMENT LIST

# OF UNITS	DESCRIPTION	CAPABILITIES
6	MOBILE DRILL MODEL B-61 TRUCK MOUNTED	HOLLOW STEM AUGER, MUD ROTARY, ROCK CORING
1	MOBILE DRILL MODEL B-57 TRUCK MOUNTED	HOLLOW STEM AUGER, MUD ROTARY, ROCK CORING
1	FAILING MODEL F-7 TRUCK MOUNTED	HOLLOW STEM AUGER LARGE DIAMETER, MUD ROTARY
1	SCHRAMM MODEL T-64 TRUCK MOUNTED	AIR ROTARY
1	CHICAGO PNEUMATIC T-650W CC MOUNTED	AIR ROTARY
3	MOBILE DRILL MODEL B-80 TRUCK MOUNTED	HOLLOW STEM AUGER, MUD ROTARY, AIR ROTARY
1	MOBILE DRILL MODEL B-80 ATV MOUNTED	HOLLOW STEM AUGER, MUD ROTARY, AIR ROTARY
1	MOBILE DRILL MODEL B-53 ATV MOUNTED	HOLLOW STEM AUGER, MUD ROTARY, ROCK CORING
1	MOBILE DRILL MODEL B-47 ATV MOUNTED	HOLLOW STEM AUGER, MUD ROTARY, ROCK CORING
1	CME-MODEL 45C TRAILER MOUNTED	HOLLOW STEM AUGER, MUD ROTARY, ROCK CORING
1	CME MODEL 45B ATV MOUNTED	HOLLOW STEM AUGER, MUD ROTARY, ROCK CORING
1	DAVEY KENT MODEL DK-5 TRUCK MOUNTED	HOLLOW STEM AUGER, MUD ROTARY, AIR ROTARY
1	ACKER SKID RIG	MUD ROTARY, ROCK CORING

Main Office
6720 Ft. Smallwood Road
Baltimore, Maryland 21226
301/789-5020
Fax 301/789-5029

Environmental And
Geotechnical Drilling
Specialists

Branch Office
Greensboro, North Carolina
1053 E. Lindsay Street
919/275-7980
919/275-8468

HARDIN-HUBER
INCORPORATED

EQUIPMENT LIST

# OF UNITS	DESCRIPTION	CAPABILITIES
3	PORTABLE TRI-POD & CATHEAD	DRIVE CASING, SPLIT SPOON SAMPLING
1	WATSON MODEL 2500 TRACK MOUNTED	LARGE DIAMETER HOLES UP TO 72" DIAMETER, 60 FT DEPTH
1	CASE MODEL 580 BACKHOE FOUR WHEEL DRIVE	EXCAVATION TEST PITS
1	FORD BACKHOE	EXCAVATION TEST PITS
1	SULLAIR 750 CFM AIR COMPRESSOR	AUXILLIARY AIR
8	INGERSOLL-RAND 185 CFM AIR COMPRESSOR	WELL DEVELOPMENT
18	PORTABLE STEAM CLEANER & GENERATORS	DECONTAMINATION
12	MISSION DOWN-THE-HOLE HAMMER VARIOUS SIZES FROM 4 1/4" DIA. THROUGH 15 1/8" DIA.	AIR ROTARY
1	HYDRO PUNCH UNIT	HYDRO PUNCH SAMPLING
3	ARDCO ALL-TERRAIN SUPPORT VEHICLES	TRANSPORATION OF WATER & SUPPLIES TO REMOTE DRILL SITES

HHI

HARDIN-HUBER
INCORPORATED

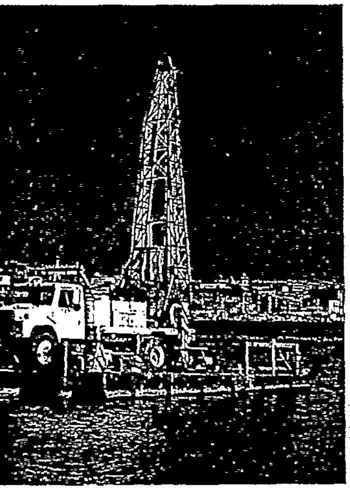
PARTIAL CLIENT LIST

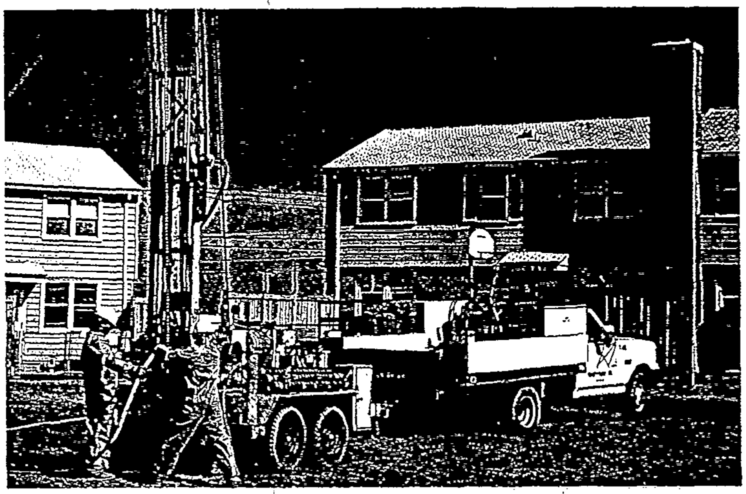
A & A ENVIRONMENTAL
AEPCO. INC.
AKA/CHRYSLER
ALLIED CHEMICAL CO.
AR WINARICK
ATEC ASSOCIATES
ATLANTIC RESEARCH CORP.
AVENDT GROUP. INC.
BAKER/TSA. INC.
BALTIMORE GAS & ELECTRIC. CO
BEAZER EAST. INC.
BELPAR ENVIRONMENTAL
BERKEL & COMPANY
BETHLEHEM STEEL CORP.
BIO-GRO SYSTEMS
BIOSPHERICS
BLACK & DECKER
BLACK & VEATCH
BLYMYER ENGINEERING
BP OIL COMPANY
BRIGGS ASSOCIATES
BROWNING-FERRIS. IND.
C-E ENVIRONMENTAL
C. A. RICH CONSULTANTS
C.C. JOHNSON & MALHOTRA. P.C.
C.K.C. INC.
CALCO SYSTEMS
CH2M HILL
CHERRY HILL CONSTRUCTION
CHESTER COUNTY SOLID WASTE
CHESTER ENGINEERING
CHEVRON. USA
CITY OF ANNAPOLIS
CLAYTON ENVIRONMENTAL
CLEMENT ASSOCIATES
CONSOLIDATED FREIGHTWAYS
CONSTRUCTION DEWATERING
CONTI CONSTRUCTION CO. INC.
CTI CONSULTANTS
DAMES & MOORE
DATANET ENGINEERING
DEFENSE MAPPING AGENCY
DELTA ENVIRONMENTAL
DEWBERRY & DAVIS
DNW ENVIRONMENTAL SERVICES
DUFFIELD ASSOCIATES
DUNN GEOSCIENCE CORP.
DYNAMAC
EA ENGINEERING. SCIENCE & TECH.
EARTH SCIENCES CONSULTANTS
EARTH TECHNOLOGY CORP.
EASTERN MICROWAVE
EASTERN STAINLESS CORP.
EASTMAN KODAK
EASTON PETROLEUM
EBA ENGINEERING
EBASCO SERVICES. INC.
ECKENFELDER. INC.
EDI ENGINEERING
E.I. DUPONT
EMPIRE SOILS INVESTIGATION
EMS ENVIRONMENTAL
ENGINEERING ENTERPRISES. INC.
ENSR CONSULTING & ENGINEERING
ENVIRO-GRO TECHNOLOGIES
ENVIRON CORPORATION
ENVIRONMENTAL & SAFETY DESIGNS. INC.
ENVIRONMENTAL PROTECTION SYSTEM
ENVIRONMENTAL RESOURCE MANAGEMENT
ENVIRONMENTAL SCIENCE & ENGINEERING
ENVIRONMENTAL STRATEGIES CORP.
ENVIRONMENTAL RECLAMATION CO.
ENVIRONMENTAL TECHNOLOGY. INC.
ESPEY HUSTON & ASSOCIATES. INC.
FISCA OIL
FISHBECK. THOMPSON. CARR & HUBER
FLUOR DANIEL. INC.
FOSTER WHEELER USA CORP.
FREDERICK WARD ASSOCIATES
GEI CONSULTANTS
GEO TRANS. INC.
GEO-CON. INC.
GEO-TECHNOLOGY ASSOCIATES. INC.
GEOSCIENCE CONSULTANTS. LTD.
GERAGHTY & MILLER HYDROCARBON SVCS
GERAGHTY & MILLER. INC.
GILES ENGINEERING ASSOCIATES
GRIFFIN DEWATERING
GROUNDWATER TECHNOLOGY. INC.
HALL-KIMBRELL ENVIRONMENTAL
HALLE ENTERPRISES
HANNA ENGINEERING
HANSON ENGINEERING. INC.
HARDIN-KIGHT ASSOCIATES
HARRISON WESTERN CORP.
HILLIS-CARNES ENGINEERING
HOMEWOOD GENERAL CONTRACTORS
HTS RISK MANAGEMENT. INC.
HUNTER ENVIRONMENTAL SVCS.
HYDRO TERRA. INC.
HYDROGEOLOGIC. INC.
HYDROSYSTEMS. INC.
HYGIENTICS. INC.
ICF KAISER. INC.
IT CORPORATION
JAMES M MONTGOMERY CONSULTANTS
J.M. SORGE. INC.
KAMBER ENGINEERING. INC.
KASELAAN & D'ANGELO
KEYSTONE ENVIRONMENTAL
KIDDIE CONSULTANTS
KNOTT DEVELOPMENT CORP
LAW ENGINEERING
LEIMBACH DEVELOPMENT
LEXICON ENVIRONMENTAL ASSOC.
LOUIS BERGER INTERNATIONAL
LVI ENERGY RECOVERY CORP.
MALCOLM PIRNIE. INC.
MARK SCHULTZ & ASSOCIATES
MARYLAND ENVIRONMENTAL SVC.
MCLAREN/HART
METCALF & EDDY
NATIONAL AERONAUTICS & SPACE ADMIN.
NATIONAL SECURITY AGENCY
NUS CORPORATION
O'BRIEN & GERE ENGINEERING
O.H. MATERIALS
OFFSHORE & COASTAL TECH. INC.
PAPADOPULOS & ASSOCIATES
PAYNE RIEMER GROUP. INC.
PETRO TECH. INC.
POST. BUCKLEY. SCHUH & JERNIGEN
PROFESSIONAL SERVICES INDUSTRIES
PSC ENGINEERS & CONSULTANTS
RADIAN CORPORATION
RALPH M. PARSON COMPANY
REMCOR
R.E. WRIGHT ASSOCIATES. INC.
RISK SCIENCE INTERNATIONAL
RIZZO ASSOCIATES
ROSENGARTEN. SMITH & ASSOC (RSA)
ROY F. WESTON
SARGENT & LUNDY
SCIENCE APPLICATIONS INT'L CORP.
SCS ENGINEERS
SIRRINE ENVIRONMENTAL CONSULTANTS
ST SERVICES
STATE OF DELAWARE UST DIVISION
STEWART PETROLEUM
STONE & WEBSTER ENGINEERING CO.
STV/LYON ASSOCIATES
SULLIVAN ENGINEERING GROUP
TAMS CONSULTANTS
TERRA VAC
TETHYS CONSULTANTS
TEXACO
TRAMMEL CROW CO.
U.S. AIR FORCE
U.S. ARMY CORPS OF ENGINEERS
U.S. ARMY TOXIC & HAZARDOUS MATERIALS
U.S. ENVIRONMENTAL PROTECTION AGENCY
U.S. GEOLOGICAL SURVEY
U.S. NAVY
U.S.T.S.C.
VERSAR. INC.
WEETER ASSOCAITES
WESTINGHOUSE ENVIRONMENTAL
WHITING-TURNER CONSTRUCTION CO.
WM. HARRINGTON & ASSOCIATES
WOODWARD/CLYDE CONSULTANTS
WOODWARD/CLYDE FEDERAL SVCS.

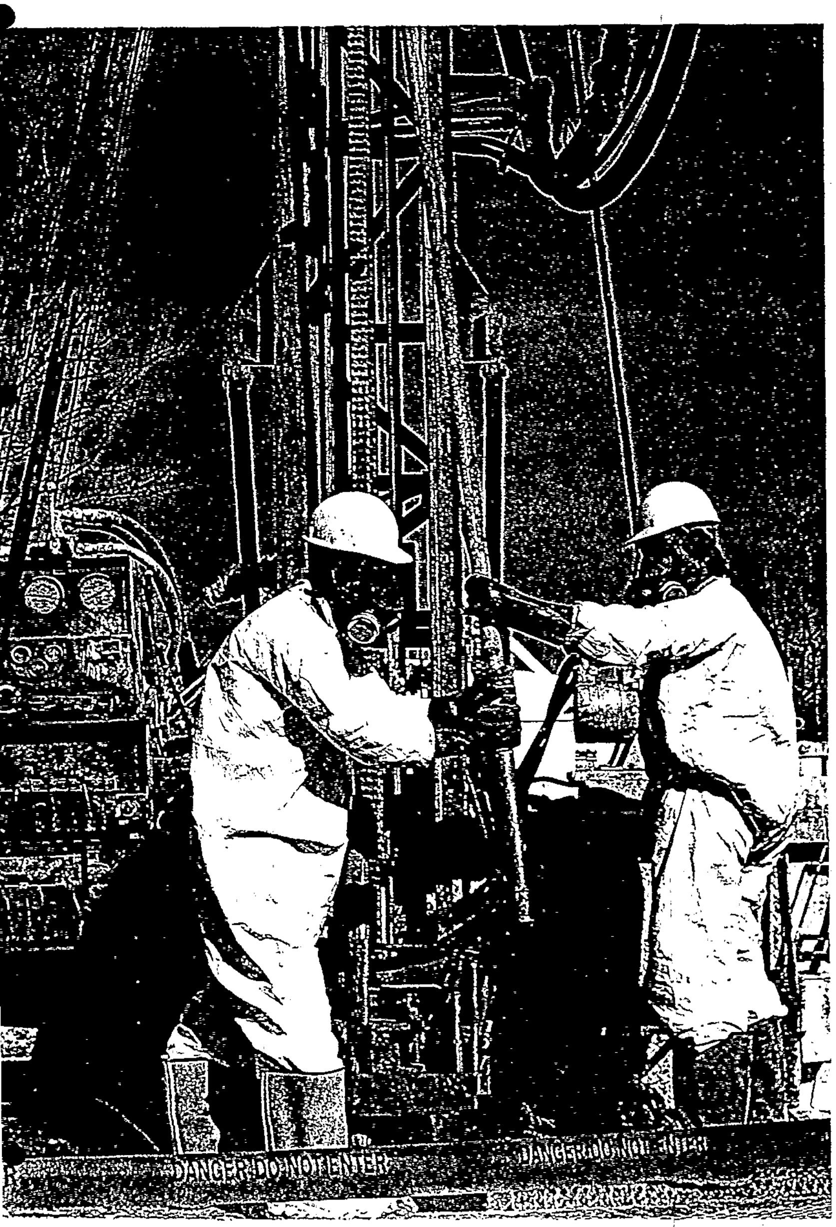
Main Office
6720 Ft. Smallwood Road
Baltimore, Maryland 21226
301/789-5020
Fax 301/789-5029

Environmental And
Geotechnical Drilling
Specialists

Branch Office
Greensboro, North Carolina







- Above Left: Off-shore drilling for contamination assessment in the Baltimore Harbor.
- Above Right: Hydro Punch® drilling for residential site investigation.
- Left: Mud rotary drilling and sampling on EPA Superfund site under level "C" Health and Safety Protection.

SCOPE OF SERVICES

- Monitoring wells
- Hollow stem augering
- Rotary mud drilling
- Air rotary drilling
- Standard penetration test borings
- Rock coring
- Offshore drilling
- Recovery wells
- Recovery systems installation
- Gas probes
- Packer pump testing
- Design and construction of decontamination pads
- Instrumentation installation
- Excavating
- Site restoration and cleanup

HARDIN-HUBER
INCORPORATED

Main Office
6720 Ft. Smallwood Road
Baltimore, Maryland 21226
301/789-5020
Fax 301/789-5029

MEMBER